THE OHIO JOURNAL OF SCIENCE

VOL. XLIV MAY, 1944 No. 3

THE FOREST RESOURCES OF AUGLAIZE COUNTY, OHIO[1]

LESLIE W. GYSEL,
The Ohio Agricultural Experiment Station,
Wooster, Ohio

This report is based on a county survey which was carried out according to the methods specified by the state-wide Ohio Forest Survey (1), a project designed to provide facts essential to public and semi-public agencies concerned with land-use planning for the improvement of the conditions of land tenure, for the integration of forestry and farm programs, and for the development of a rural works program. To obtain these facts, information has been collected concerning the quantity of timber, the location and size of all woodlands, the forest type and condition class of each, the economic aspects of the woodlands, and woodland management problems.

Briefly, the survey methods are as follows. Tracings are prepared from aerial photographs to show the location, shape, and area of all existing woodlands. A random sample of these woodlands is selected for cruising, the percentage selected varying in accordance with the total number of woodlands. From the total of 1,496 woodlands in Auglaize County, 504 were selected for cruising. The timber inventory is based on a tally of the species and diameter of each tree in a series of mechanically located fourth-acre plots established within the individual woodlands. Intensity of cruise of an individual woodland varies inversely with the acreage of the woodland. Of the 16,001 acres of woodland in Auglaize County, timber on 1,772 acres was tallied, affording a 11.1 per cent cruise. Forest cover type and condition class based on field inspection are determined for all woodlands, both cruised and uncruised. The distribution of reproduction by species and size class is recorded for hundredth-acre plots established in cruised woodlands.

GENERAL DESCRIPTION OF THE COUNTY

Physical Features:

Auglaize County is located in the west central part of Ohio, 19 miles from the Indiana border and 72 miles from the Michigan border. The total area is 397 square miles or 254,080 acres which is divided into 14 townships, only six of which have 36 sections.

The terrain of a large part of the county is gently undulating. Some large areas, however, are nearly level and others hilly. The undulating land is, in general, ground moraine and the hill areas are recessional moraines, three of which occur in the county. The whole region is covered by the Lake Wisconsin Drift which overlies limestone bedrock, the Niagara Limestone in the southern part of the county and the Monroe Limestone in the northern part (5).

[1]Acknowledgments: This survey was conducted in 1940 through the cooperative efforts of a group of organizations, mainly: The Work Projects Administration, The Department of Forestry of the Ohio Agricultural Experiment Station, The Agricultural Conservation Association, The Central States Forest Experiment Station, The Ohio Forestry Association, The Izaak Walton League of America, and numerous wood-using industries throughout Ohio.

Of the soils which have developed from this glacial drift, the Miami silty clay loam is the most important in regard to area and is found mainly on undulating or rolling terrain with fair to good surface drainage. Bellefontaine silt loam occurs on the well-drained areas of the hills. Of the soils which occur on the level to slightly undulating terrain, the Crosby and Brookston silty clay loams are dominant. Two forest humus layer types are predominant in the woodlands of the county, the course mull which occurs mainly in the closed ungrazed forested areas, and the firm mull which occurs in the open grazed farm woods. The depth of these humus layers varies approximately from 2 inches to 12 inches, and is greatest in the poorly drained soils.

Cultural Features:

The most important factors affecting the original vegetation, other than the physical, are directly or indirectly due to the influence of man. Therefore, in order to explain the extent, condition, and type of farm woodlands in the county, the cultural features must be considered. An analysis of the economic data for

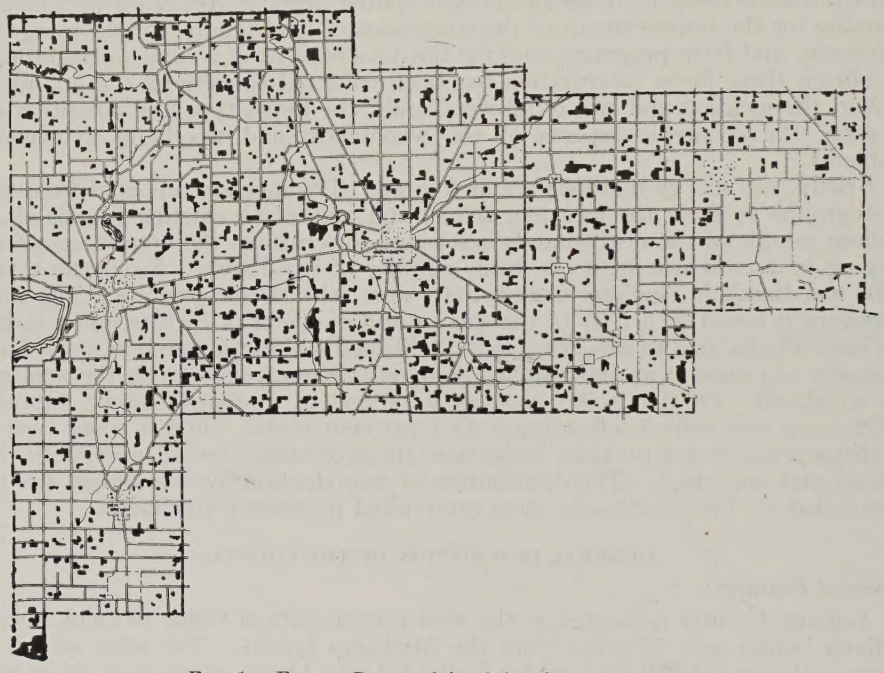


FIG. 1. Forest Cover of Auglaize County, 1940.

Auglaize County indicated that farmwoods are a secondary source of income for the farms of the county because of the adaptability of the land for intensive agriculture, the relatively high land values, and the type of farming. In general, the combination of good soil and good agricultural methods has made the cultivation of crops and the raising of cattle, sheep, and hogs profitable. As a result of the high value of these products and of the land, the farmwoods have become a neglected asset.

FOREST DESCRIPTION

The Original Forest Cover:

In order to fully understand the present forest conditions, it is necessary to have at least a general knowledge of the original vegetation. According to

Transeau and Sampson swamp forests covered most of the county with beech and sugar maple as the dominant species on the well-drained sites. This large area of swamp forest consisted of a number of different phases which are designated by the following types: Willow-Cottonwood-Sycamore, Elm-Ash-Maple, Bur Oak-Swamp White Oak-Hickory, and Red Oak-Basswood. Gordon (2) states that associated with the beech and sugar maple on the better drained sites were Northern red oak, white ash, yellow poplar, white oak, red maple, bitternut hickory, shagbark hickory, buckeye, basswood, blue beech, and hop hornbeam. According to the field notes of the original land survey, beech was apparently a much more important dominant than is indicated by present conditions (Figs. 3 and 4).

Williamson (4) states that "up to 1845 Auglaize County was unsurpassed for its stately trees of many valuable varieties. The splendor of its flora was displayed in its oaks, black walnut, butternut, poplar, hickory, ash, wild cherry, linden, tulip tree, with almost endless varieties of trees of minor value." After 1832 a part of this forest was cleared for agricultural purposes, especially during the period from 1845 to 1856.

The Woodlands of the Present Day:

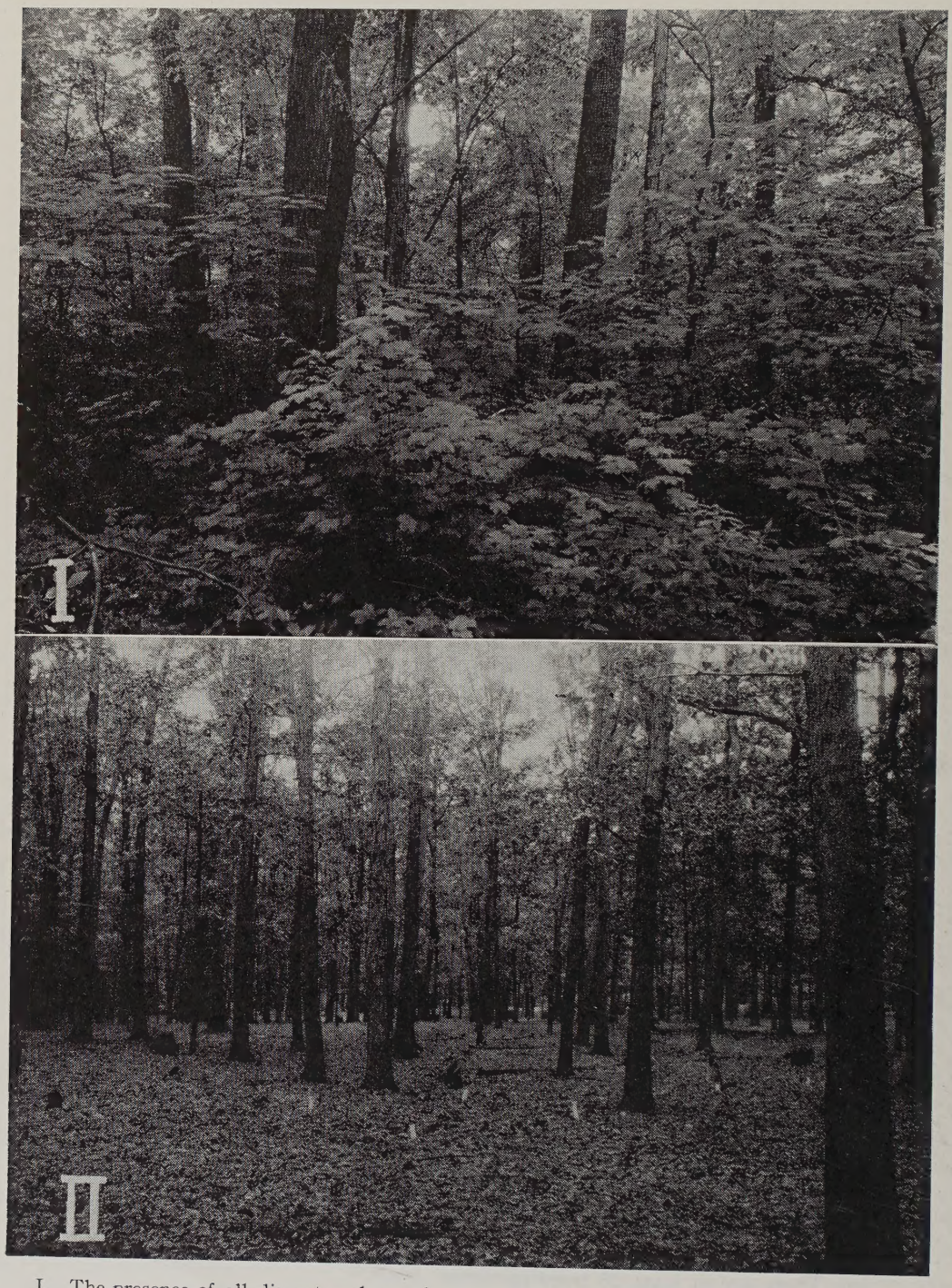
The forest lands of the county are now, with few exceptions, small farm woodlands. There are 1,496 of these woodlands which make up a total area of 16,001 acres, or 6.3 per cent of the total area of the county. The individual woodlands vary considerably in size; the smallest considered in the survey was 3 acres and the largest was 122 acres. There are very few large woods, however, the average woodland for the county being only 10.9 acres in area. In general the woodlands are quite evenly distributed throughout the county except in the flat prairie land where there is a relatively small number per unit area.

Condition Classes: Each of the farm woodlands in the county has been classified according to the character of its stocking. The unit of this classification is the condition class which is important because a knowledge of woodland structure is essential for a complete understanding of the management problems, the economic values, and the ecological aspects of the forest types. The eight condition classes are illustrated pictorially and the descriptive characteristics of each as designated in the survey are given:

Class I—All-aged Stand (Plate I).
- (a) The trees are well distributed from the reproduction to the medium or large timber size classes.
- (b) The crown canopy is closed or nearly so.
- (c) The deposit of leaf litter is good to excellent.
- (d) There is little or no evidence of grazing.

Class II—Transition Stand (Plate I).
- (a) Trees in the reproduction class are sparse or lacking.
- (b) The crown canopy is 75 per cent or less.
- (c) The woodland is, or until very recently has been, grazed.
- (d) Grass and weeds are becoming established in the openings.
- (e) The deposit of leaf litter is poor.

Class III—Open-park Stand (Plate II).
- (a) Trees in the reproduction class are sparse to lacking, and there are few trees in the pole size class; trees in the small timber class and above are normally distributed, or approximately so.
- (b) The crown canopy is less than 75 per cent.
- (c) There are at least 25 trees per acre.
- (d) The stand has been intensively grazed over a long period of years.
- (e) There is sod present.



I. The presence of all diameter classes from reproduction upward is the outstanding characteristic of Class I woodlands.

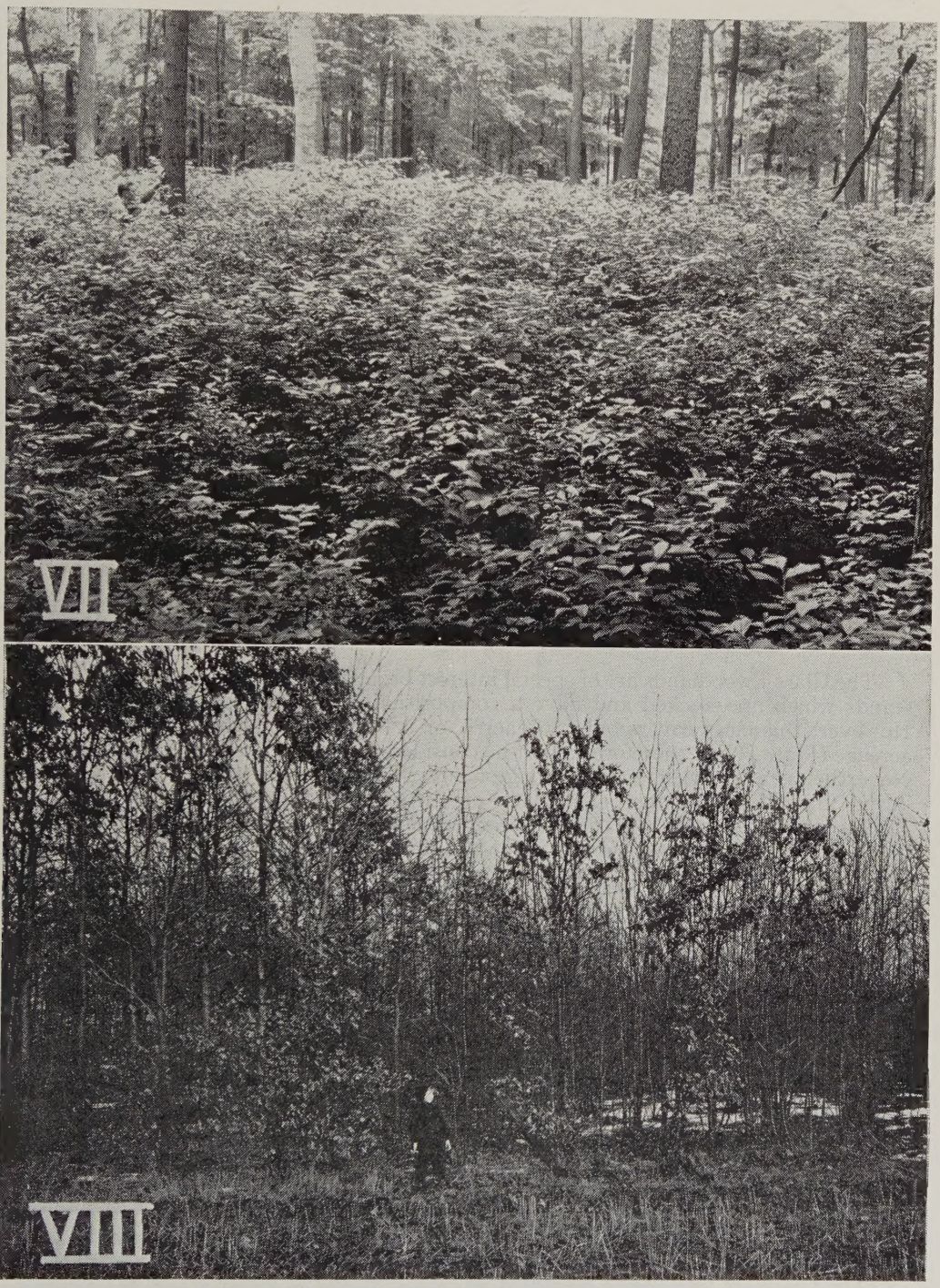
II. The almost total absence of trees of reproduction size, but an otherwise good distribution of size classes, characterizes Class II stands.

III. Features which distinguish Class III woodlands are: the open condition of the stands, the presence of sod on the forest floor, and the preponderance of trees in the larger diameter classes.

IV. Well-stocked stands made up almost exclusively of pole-size trees are called Class IV.

V. Poorly stocked pole stands are called Class V. Grass sod is usually present in the openings.

VI. Pole stands with from 6 to 18 larger trees per acre in the overstory are characteristic Class VI woodlands.



VII. Definite two-storied forests caused by the absence of one or more diameter classes of pole size are called Class VII.

VIII. Trees of reproduction size, originating either from clear-cut stands or volunteer growth on abandoned fields, are mapped as Class VIII.

Class IV—Well-stocked Pole Stand (Plate II).

(a) The trees are mainly in the size classes below the small timber class, i.e., less than 13.0 inches d.b.h. The number of trees in the small timber class and over does not exceed 6 stems per acre.
(b) The crown canopy covers 60 per cent or more of the area.

Class V—Scattered Pole Stand (Plate III).

(a) Resembles Class IV, but is not as heavily stocked.
(b) The crown canopy is less than 60 per cent.
(c) Patches of sod are usually present.

Class VI—Pole Stand with Scattered Large Trees (Plate III).

(a) The trees in the pole and reproduction classes approximate the number of those found in Class I stands.
(b) The number of trees in the small timber class and over is between 6 and 18 per acre.

Class VII—Two-storied Stand (Plate IV).

(a) A stand in which the trees are well-distributed throughout the size classes with the exception of the pole size class which is scarce or lacking.
(b) The over-story has at least 20 trees per acre, and there is a total of at least 25 trees per acre 3.0 inches d.b.h. and over.

Class VIII—Reproduction Stand (Plate IV).

(a) The ground area is at least 25 per cent covered by well-distributed tree reproduction which is 3 feet or more in height.

The Class I woodlands are of special interest because they are the only remaining stands which are stocked and have a composition similar to the original forests. However, this class covers only 867 acres, or 5.4 per cent of the total woodland acreage (Plate I) and therefore cannot be considered of major economic importance. Nevertheless a knowledge of the make-up of these stands is valuable for formulating management plans. The data presented in the stand and stock table (Table I) show very clearly the balanced character of the stand. The total basal area for the average acre is 79.4 square feet for this class. Basal area is the term used to designate the area in square feet of the cross section of a tree 4½ feet above the ground. It may be applied to a single tree or it may be the combined area of the trees on some given area, usually one acre. In this discussion it is on a per acre basis. In comparison with the other classes, this figure is somewhat greater, but due to the fact that in many cases the largest trees have been removed by selective cuttings from Class I stands, it is lower than that which would have been characteristic of virgin stands. In areas in which many of the large trees have been preserved, the total basal area averages slightly more than 100 square feet per acre, the largest recorded being 118.8 square feet. The reproduction is generally abundant and of good quality; the number of stems, which averages 934 per acre, is considerably greater than for any of the other classes.

Condition Class II is much more important in the county than Class I because the woodlands in this classification make up approximately 25 per cent of the total woodland acreage of the county. In form, as shown by the number of stems and basal area of the typical acre (Table I), the stands are not greatly different than those in the Class I condition; however, the average number of stems in the reproduction size class is about two-thirds less.

The Class III woodlands represent advanced stages of forest stand decadence. The data for the average acre of the class indicate the lack of trees below 13

inches in diameter. However, the distribution in the larger size groups is very similar to that of the first two condition classes. There is only a small amount of reproduction in these woodlands which in many cases consists entirely of inferior species; the average of 300 stems per acre of which a large percentage are small seedlings is the lowest number for all of the condition classes. Approximately 17 per cent of the total woodland acreage is in this class, and therefore it is an important part of the forest area.

Class IV and V woodlands generally result from the growth of sprouts and advance reproduction after the clear-cutting of a stand, or from the natural regeneration on abandoned farmland. In regard to the number of trees per acre, these stands are almost as dense as those in the Class I condition, but the basal area is less than half. Both of these classes together comprise only 11 per cent of the total forest acreage, and generally the stands are small in size.

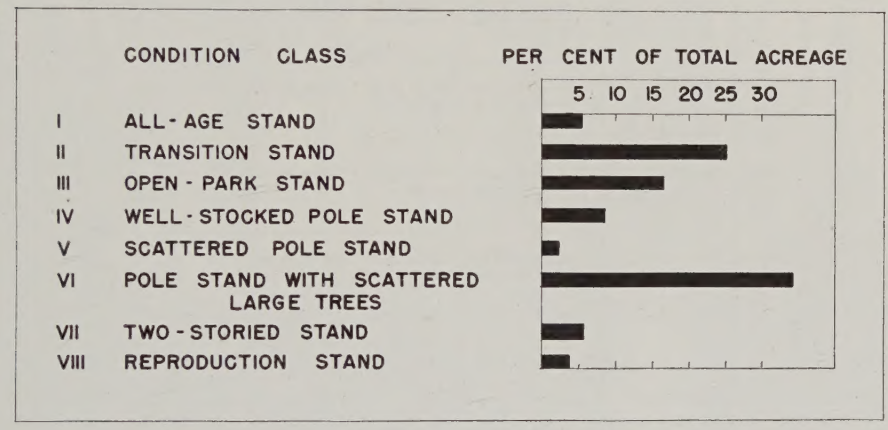


FIG. 2. Distribution of woodland acreage by condition class.

Class VI woodlands are the most typical of the county. The largest number of stands and also the greatest acreage are in this class. Woodlands in this condition occupy 34.1 per cent of the total woodland area, or 5,449 acres. This form of stand generally results from severe cuttings in which all but a few of the larger cull trees are removed. Due to the small number of trees above the pole size, the basal area is relatively low, although the total number of stems in this class approximates the number of those found in Class I stands. Although approximately 75 per cent of the stands are grazed, it is generally light so that reproduction is quite abundant; the typical acre of a Class VI woodland has an average of 751 stems in the reproduction size class.

Class VII is relatively unimportant in regard to area covered since it comprises only 5.1 per cent of the total woodland acreage. The elimination of grazing from old Class II or III stands and subsequent establishment of reproduction may result in a two-storied woodland.

Class VIII woodlands are found on clear-cut forest land or on abandoned farmland. Since most of the cleared land is readily adaptable and valuable for farming, only 3.4 per cent of the total woodland acreage has reverted to this condition.

TABLE I

STAND AND STOCK TABLE BY CONDITION CLASS—TYPICAL ACRE

DBH	Class I		Class II		Class III		Class IV		Class V		Class VI		Class VII		DBH
	No. Stems	B.A. Sq. Ft.	No. Stems	B.A. Sq. Ft.	No. Stems	B.A. Sq. Ft.	No. Stems	B.A. Sq. Ft.	No. Stems	B.A. Sq. Ft.	No. Stems	B.A. Sq. Ft.	No. Stems	B.A. Sq. Ft.	
4	47.4	4.7	35.4	3.5	7.1	.7	71.6	7.2	39.8	4.0	51.1	5.1	25.9	2.6	4
6	26.9	5.4	21.2	4.2	6.9	1.4	32.6	6.5	22.2	4.4	28.1	5.6	12.5	2.5	6
8	17.0	5.1	14.1	4.2	7.6	2.3	15.1	4.5	14.2	4.3	17.4	5.2	9.6	2.9	8
10	12.3	6.1	10.6	5.3	8.2	4.1	8.4	4.2	10.0	5.0	11.9	5.9	7.5	3.7	10
12	10.7	8.6	9.3	7.4	8.2	6.6	5.2	4.2	7.3	5.8	8.5	6.8	6.9	5.5	12
14	7.5	8.2	7.4	8.1	7.1	7.8	2.7	3.0	4.1	4.5	5.9	6.5	5.5	6.0	14
16	6.3	8.8	5.6	7.8	6.1	8.5	1.2	1.7	2.1	2.9	4.3	6.0	4.4	6.2	16
18	4.8	8.6	4.2	7.6	4.2	7.6	.9	1.6	1.0	1.8	2.9	5.2	3.3	5.9	18
20	3.4	7.5	2.7	5.9	3.0	6.6	.7	1.5	.4	.9	2.1	4.6	2.1	4.6	20
22	2.3	6.0	2.0	5.2	1.8	4.7	.1	.3	.1	.3	1.3	3.4	1.3	3.4	22
24	1.0	3.1	1.0	3.1	1.3	4.0	.1	.3	.1	.3	.7	2.2	.8	2.5	24
26	.8	3.0	.8	3.0	.8	3.0	.1	.4	.1	.4	.4	1.5	.6	2.2	26
28	.5	1.0	.4	1.7	.4	1.7	.1	.4	.1	.4	.2	.8	.2	.8	28
30	.3	1.5	.2	1.0	.2	1.0	.1	.5	.....	.....	.2	1.0	.2	1.0	30
32	.2	1.1	.1	.6	.2	1.1	.....	.....	.....	.....	.1	.6	.2	1.1	32
34	.1	.7	.2	1.5	.2	1.5	.....	.....	.....	.....	.1	.7	.2	1.6	34
Total	141.5	79.4	115.2	70.1	63.3	62.6	138.9	36.3	101.5	35.0	135.2	61.1	81.2	52.5	Total

A Class I white oak-sugar maple woodland in Pusheta Township.

Forest Types: Nine forest types were selected for the purpose of classifying the woodlands as to species composition. A cover type in this survey is defined and named by the dominants which comprise 50 per cent or more of the crown cover, or, if there are no dominant species, by the general composition of the stand. Each woodland is designated by one cover type.

The Mixed Hardwood Type: This type is the most extensive in the county, although only slightly more so than the Oak-Hickory type. It occupies 21.4 per cent of the total woodland area, or 3,432 acres (Fig. 3), and is therefore of considerable importance. Many of the better woodlands of the county are of this type, since 37 per cent of the total acreage of the type is in Classes I and II. However, there is also approximately an equal acreage in Class VI.

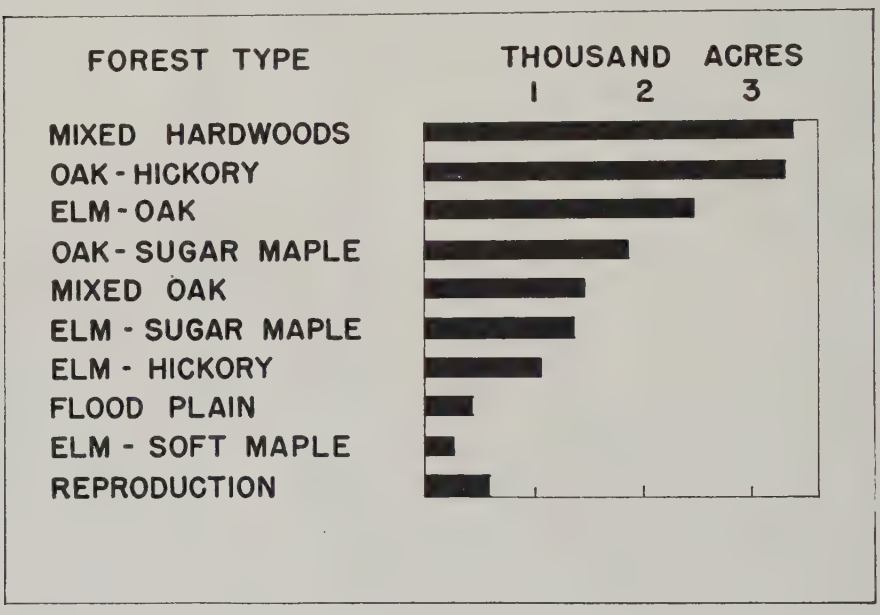


Fig. 3. Distribution of woods acreage by forest type.

As the type name indicates, it is composed of a mixture of hardwoods in which there is no one or small group of species which dominate the stand. The American elm is the most important tree in regard to total basal area and number of stems. It is generally a scattered component and is distributed throughout the various size classes. Of the remaining species which make up the type, hickory, white ash, sugar maple, basswood, beech, and red oak are the most prevalent. In individual woodlands, however, various other species of the total of 48 which were reported for the type may also be important.

Most of the major type species are well represented in the reproduction. American elm is again the most important species with ash and hickory of secondary importance; white and red oak are very sparse. Less desirable small tree species such as *Crataegus*, blue beech, and hop hornbeam, are quite abundant.

Approximately one-half of the woodlands of this type are well-drained and the remaining half partially or poorly drained. The individual woodlands generally occur on undulating or slightly rolling topography and may therefore be composed of a number of type phases. Various phases of the swamp forest such as elm-ash-

maple, bur oak-swamp white oak-hickory, and red oak-basswood probably covered most of these sites originally. Beech, no doubt, was also an important component as shown by the original land survey data (Fig. 4).

Oak-Hickory Type: Second in importance from the standpoint of acreage covered is the Oak-Hickory type, which has a general distribution throughout the county. The economic value, however, is relatively small because of the large proportion of pole size elm and hickory and the poor form of the larger trees. Most of the stands have been quite heavily cut and grazed. Approximately 46 per cent of the total acreage of the type is about equally divided between Classes II and III, and 35 per cent is in Class VI.

There are two sub-types of the Oak-Hickory type. One occurs on well- or moderately well-drained sites and the other on poorly drained habitats. The former

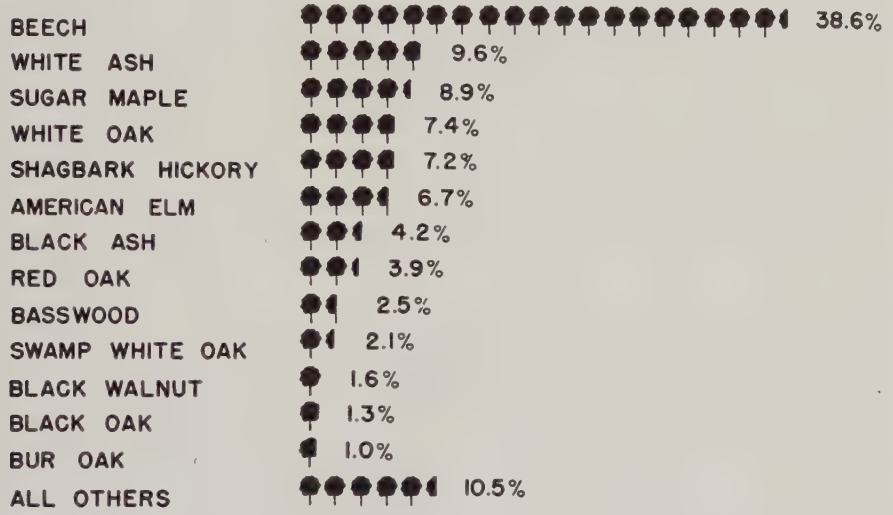


FIG. 4. Percentage composition of the number of stems in the samples of the original vegetation. From notes on the Original County Land Survey.

is the most important since only about one-seventh of the woodlands of this type are poorly drained. Hickory, white oak, American elm, red oak, miscellaneous hickory,[2] and white ash are the important components on the well-drained lands. On the poorly drained sites, hickory, American elm, swamp white oak, chinquapin oak, pin oak, bur oak, soft maple, and black ash are the dominant constituents. Hickory and American elm are the most important species in the reproduction in both drainage conditions; the oaks are very sparse.

The Oak-Hickory type on the well-drained sites appears to be primarily the result of biotic factors such as cutting, grazing, and drainage in original stands of oak and sugar maple. The poorly drained Oak-Hickory sub-type was probably a transition phase of the original swamp forest.

Elm-Oak Type: The Elm-Oak type is quite similar to the Oak-Hickory type in regard to the percentage distribution of the woodlands in the condition classes. Various species of oaks, American elm, and hickory are the chief dominants.

[2]In this report miscellaneous hickories refer to those other than shagbark and shellbark hickory.

This type, since it includes 15.6 per cent of the total woodland acreage, is a significant part of the forest cover.

The Elm-Oak type occurs more frequently on the poorly drained sites than does the Oak-Hickory type. American elm, red oak, white ash, bur oak, swamp white oak, and hickory are the important components of the average stand. White oak and sugar maple are prominent associate species on the well-drained sites. In the reproduction, American elm, white ash, and hickory are abundant in all condition classes, whereas the lack of oak is very marked.

The Elm-Oak type probably became more important after the cutting and grazing of some of the phases of the original swamp forest. Evidences of such a change occur in Class VI stands in which many of the old cull trees are poorly shaped swamp oaks and the young growth is composed of elm, hickory, and white ash.

Oak-Sugar Maple Type: This type occurs most extensively on the well-drained sites and is found mainly in the central part of the county. Sugar maple, red oak, and white oak are the characteristic dominant species. Of the associate species, American elm, shagbark hickory, white ash, and basswood are the most important. Many of the stands are in excellent condition and are the most valuable woodlands in the county. As in other oak types, however, the oak reproduction is very sparse; American elm, sugar maple, and white ash are the most abundant in this size class.

The Oak-Sugar Maple type was probably a part of the original vegetation. Its former importance is not known, but the range of occurrence may have increased after settlement because of the improved drainage conditions in the swamp forest areas.

Mixed Oak Type: The Mixed Oak woodlands also occur on well-drained sites throughout the county. The type can be further subdivided into two sub-types, one which is limited to the best drained sites and the other to the moderately well-drained habitats. White and sometimes black oak are dominant on the former areas whereas red, bur, swamp white, pin and chinquapin oak are the most abundant on the latter. There are 27 other tree species listed for the type, most of which, however, are of minor importance. The principal associate species are American elm, shagbark hickory, basswood, sugar maple, beech, and white ash. From an economic point of view, this type is particularly important because of the high percentage of valuable species.

The early settlers probably found stands of mixed oak when they first arrived in the county. The original composition has, no doubt, changed since the time of settlement and is still changing as indicated by the small percentage of oak in the pole size class and the lack of this species in the reproduction. American elm, white ash, and hickory are the dominants of the reproduction size class.

Elm-Sugar Maple Type: Three species, sugar maple, American elm, and slippery elm make up approximately 50 per cent of the basal area and the number of stems of the type. These species are also the most abundant in the reproduction. However, from the present indications in the field, it seems possible that many of the stands were originally Beech-Sugar Maple. The severe cutting prevalent in this type may account for the dominance of American elm and slippery elm.

The center of distribution of the Elm-Sugar Maple type within the county is in the recessional moraine area which is generally hilly and well-drained. It is in this area that nearly all of the county's maple syrup is produced.

Elm-Hickory Type: The Elm-Hickory type has developed largely as a result of biotic factors. Of the total acreage, 69 per cent, or 728 acres, is included in Classes IV, V, and VI. No stands of the Elm-Hickory type were found in the Class I condition. Of the total number of stems in the type, 92.2 per cent are

in the pole size class. Approximately 50 per cent of this class is divided equally between hickory and American elm; therefore the economic value of this type is low. Fortunately it covers only 6.6 per cent of the total woodland acreage.

The Elm-Hickory type occurs generally on moderately well-drained sites on which some phases of the swamp forest or the sugar maple types originally existed. After severe cutting in forest stands and on abandoned fields, the lack of oak reproduction and the abundance of elm and hickory reproduction favored the development of the present type of stand.

Flood Plain Type: The characteristic forest vegetation of the flood plain occurs mainly on the alluvial soils of the first bottoms of the Auglaize and St.

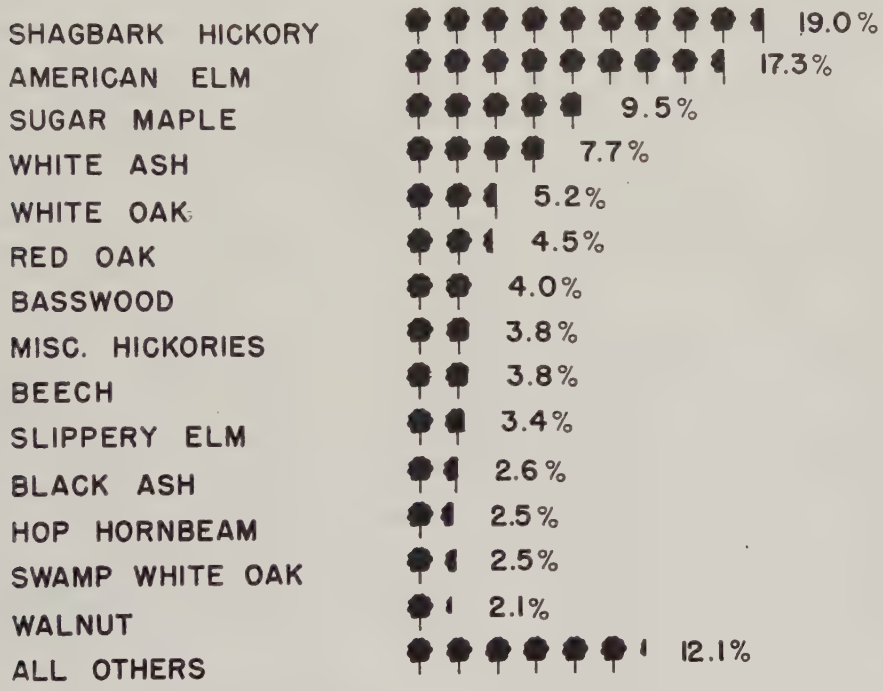


FIG. 5. Percentage composition of the number of stems in the farm woodlands, all types (from survey data).

Marys rivers. This vegetation is influenced by the high water table and, therefore, the type is considered as a phase of the swamp forest. Of the total woodland acreage, 2.1 per cent, or 343 acres, was classified as the Flood Plain type.

The fact that 41.5 per cent of the acreage of the type is in Classes I and II indicates that severe cutting has been less extensive than in any of the other types. Part of the reason for this is the small number of valuable species. American elm is dominant with one-fourth of the total basal area. Other species which make up the mixed stand are: cottonwood, swamp white oak, sycamore, hackberry, honey locust, white ash, willow, and box elder.

There are other phases of the swamp forest on many areas bordering Lake St. Marys which might be considered as variations on the Flood Plain type. Where the water is quite deep throughout the year, cattails are the main vegetation, but towards the edges of the swamps in areas which have only an inch or two of standing

water in the summer, willow is a scattered species. Further back on the better drained areas, cottonwood, American elm, and white ash are the dominants. On those sites which are only periodically flooded, swamp white oak and American elm are the main species which are associated with sycamore, cottonwood, pin oak, and white ash.

Elm-Soft Maple Type: This type covers only 191 acres, or 1.1 per cent of the total woodland area, and includes only a few valuable species. The economic value is therefore small. It is of ecological interest, however, since it occurs mainly on the poorly drained sites and was probably a phase in the original swamp forest. White ash is an important component of the type from the standpoint of the number of stems, but the basal area is relatively small because a large percentage of the trees are in the pole size class. Sycamore, black ash, pin oak, beech, basswood, cottonwood, hickory, and swamp white oak are the most prevalent associate species.

A Summary of the Species Composition of All Types: The species of the oak genus which occur in the county are collectively the most important vegetation of the woodlands from the standpoint of value, volume and percentage of cover. Four of the oaks—red, white, bur, and swamp white—comprise 28.3 per cent of the total basal area of all the types; chinquapin, pin, black, and shingle oak make up a small additional percentage. However, all of the oaks make up only approximately 12 per cent of the total number of stems of all types (Fig. 5) which indicates that there is a relatively high proportion of the trees in the large size classes. The small amount of oak in the reproduction and pole size classes has been noted in all types.

It has been quite apparent from the previous discussion of the types that two of the most important tree species in regard to the total number of stems and basal area are the American elm and shagbark hickory. The sum of their basal areas accounts for 27.7 per cent of the total for all types and is just slightly less than that of the oaks, but in this case the percentage of the number of stems is about three times that of the oaks, or 36.3 per cent of the total number of stems of the county. The number of trees in the small size classes is, therefore, relatively large.

The other species which merit special mention are sugar maple and white ash. Both occur predominately in the pole size class although not to such a marked extent as hickory and elm. Other species which occur extensively throughout the county are basswood, miscellaneous hickory, beech, slippery elm, black ash and walnut.

ECONOMIC ASPECTS OF THE WOODLANDS

Home Consumption of Forest Products:

Accurate data pertaining to the uses and values of the various woodland products are very hard to obtain because the majority of the woodland owners had no written records and were only able to make rough estimates. However, it is possible to designate general trends from the data obtained. The wood products which are used directly on the farm make up the most important part of the income from the farmwoods. Fuelwood is by far the most important product and was noted for almost every woodland for which the information was available. Only a small number of woodland owners in seven townships reported regularly yearly sales of wood or wood products. Many, however, reported occasional sales of saw timber, fuelwood, and posts.

Returns from Woodlands:

In order to improve the neglected farm forestry conditions in the county, considerably more interest in this field must be created. Probably the only way

to create this interest in the majority of cases is to show resulting profits. A good example of a profitable 53-acre woodland, an ungrazed all-aged stand of the Elm-Oak type, was found in Salem Township. A record of the returns is shown in Table II. Under a continuous yield plan of management, the owner has received $175.43 yearly or $3.31 per acre since 1904. Another farmer reported a return of $8.97 per acre over the same period.

TABLE II

RETURNS FROM 53-ACRE WOODLAND

YEAR	ITEM, QUANTITY, AND UNIT VALUE	VALUE RECEIVED (Dollars)
1904	Maple syrup, 10 gal. @ $1.00 per gal.	$ 10.00
1905	White oak, 400 trees @ $10 per tree	4,000.00
	Fuelwood sold, 200 cd. @ $1.00 per cd.	200.00
1906	Fuelwood sold, 200 cd. @ $1.00 per cd.	200.00
1916	White ash	700.00
1918	Fuelwood sold, 40 cd. @ $2.00 per cd.	80.00
1920	Ironwood for rollers	5.00
	Oak, 2,500 bd. ft. @ $20 per M bd. ft.	50.00
	Fuelwood sold, 50 cd. @ $1.00 per cd.	50.00
1923	Oak, 2500 bd. ft. @ $20 per M bd. ft.	50.00
1925	Elm and Hickory, 3750 bd. ft. @ $20 per M bd. ft.	75.00
1929	Pin Oak, 65 trees @ $2.00 per tree	130.00
1930	Oak and Elm for farm use, 2,000 bd. ft. @ $20 per M bd. ft.	40.00
1935	Elm and Red Oak, 1,500 bd. ft. @ $16.50 per M bd. ft.	25.00
1939	Ironwood for rollers	6.00
1905 to 1940	Fuelwood for farm, 20 cd. per year @ $1.00 per cd.	700.00
	Total income received	$6,321.00

The thirteen woodland owners who reported a yearly production of maple syrup produce 1,067 gallons for an annual return of $1,803. The largest single producer maintains a 50-acre woodland for this purpose only on which 600 trees are tapped each year. The average production is 300 gallons per year, which at $1.50 per gallon yields $450 per year or on a per acre basis $9.00.

Markets and Utilization:

An investigation of the wood-using industries shows that there are markets within the county for all of the more important tree species. In addition it was found that two of the industries are importing high-quality hardwoods from other states or from distant markets in Ohio, namely, white ash, hickory, and sugar maple, which could be grown in properly managed farmwoods within the county.

The wood-using industries are an important part of the economic assets of the

county. There are a total of 24, of which 17 are sawmills. The latter cut an average of 2,400 M bd. ft. per year, most of which is local timber. The other industries which include manufacturers of spokes and wheels, furniture, white ash handles, and wood products for constructional purposes utilize 4,230 M bd. ft., a part of which is imported into the county. For the operation of these industries, 330 persons are employed permanently and 34 part time.

WOODLAND MANAGEMENT

Methods of Cutting:

In the few stands in the county which are somewhat similar to the virgin forests, a selective type of cutting should be made in which only the mature trees are removed. This basic type of cutting should, in practice, be limited by the amount of annual growth so that a sustained yield results. The largest amount of cutting in the near future, however, will necessarily be in the poorer stands. In these cases the object should be to re-establish a well-stocked all-aged stand of valuable trees so that in the future a sustained yield plan may be carried out. The poorly shaped or decayed trees, whether they are mature or immature, should be removed as quickly as they can be utilized for fuelwood or posts to make room for the more valuable species, especially in dense stands. In more open stands, however, care must be taken to maintain a suitable crown cover for the purpose of creating a favorable environment for desirable reproduction.

Grazing:

One of the most important factors which will help to create more productive stands of timber in the county is the elimination of grazing from the farmwoods. It was found that 1,122 woodlands, 75 per cent of the total number, are grazed by cattle, sheep, or hogs. As a result, deterioration of these woodlands is gradually taking place by the elimination of tree reproduction as well as the herbaceous and shrubby layers, the increase of grass sod, the loss of the litter layer, the compacting of the humus layer and the surface mineral soil (Plate VI), the exposure and injury of the roots of certain tree species, and in some instances the mechanical injury to tree trunks.

Disease Control:

Rots due to fungi were found important in certain tree species. Every sawyer stated that a heart rot of red oak is very common and destructive. Trunk rots are also very common in beech, and in many cases the top limbs are also partially decayed. In grazed stands the exposed roots of sugar maple and beech are infected very frequently by rots. Losses resulting from these causes can be minimized mainly by the removal of the cull and over-mature trees in the initial cuttings, thus saving only the best trees for the final crop, and also by the elimination of grazing.

SUMMARY AND RECOMMENDATIONS

Auglaize County is mainly an agricultural unit in which the woodlands are of secondary importance in regard to value and land coverage. Originally, however, this region was almost entirely covered with swamp forests. Cutting, grazing, and drainage are the most important factors which have brought about the woodland conditions of today.

Only 6.3 per cent of the total area of the county is now forested. The woodlands, which are usually a section of a farm, are generally small units, the average size of which is 10.9 acres. Of the total woodland area, only 5.4 per cent is comparable to the original stands in composition and structure. Severe cutting characterizes a large number of the woodlands as shown by the fact that 34 per

Effect of Livestock Grazing on Forest Soil.

A—A firm mull, characteristic of heavily grazed open forest stands, the surface horizon of this profile is relatively non-porous, very compact, and difficult to distinguish from the layers beneath. Very few earthworms were found, and the roots were small and very scattered.

B—A coarse mull, characteristic of ungrazed, well-managed woodlands. A loose litter layer overlies the mull which comprises the surface horizon of the profile. It is a dark, porous, granular layer, two to three inches in thickness, with a large earthworm population and an abundance of roots scattered throughout.

cent of the total forested area is composed of young growth with a few scattered large trees, and 17 per cent is open park grazed stands.

For the county as a whole, the oaks as a group are the most important vegetation in the woodlands in regard to value and cover. However, one of the most noticeable observations made in this survey was that there is only a small number of trees of this genus in the reproduction of all types. The important individual tree species according to the total number of stems and total basal area are the American elm and shagbark hickory. Both species are present in all types and are generally dominant in the reproduction. Sugar maple and white ash are valuable species which also occur throughout the county.

The values of the forest products and of the wood-using industries are important economic factors within the county. For the average farm, fuelwood is the most important woodland product; saw timber and posts are of secondary importance.

There is no doubt that it is possible to better the conditions of the farm woodlands and also to increase their productivity and value. In order to accomplish this, the following general recommendations are made:

1. Woodland owners should be shown the value of highly productive stands and the methods of obtaining such stands.
2. The farmers who sell timber should have a knowledge of the methods of estimating volume and the best methods of marking and cutting.
3. The sawmill owners who buy and cut the timber should be fully informed of the value of continuous yields.
4. Grazing of woodlands should be eliminated.

LITERATURE CITED

(1) **Diller, O. D., et al.** *Ohio's Forest Resources.* Ohio Agr. Exp. Sta., Forestry Pub. 76, 1944.
(2) **Gordon, R. B.** *The Primary Forest Types of the East Central States.* Ph.D. Dissertation, Ohio State University, 1931.
(3) **Sitterley, J. H.,** and **Falconer, J. I.** *Better Land Utilization for Ohio.* Ohio State University and Ohio Agr. Exp. Sta. Dept. of Rural Economics Bul. 108. 1938.
(4) **Williamson, G. W.** *History of Western Ohio and Auglaize County.* Press of W. M. Linn and Sons, Columbus, Ohio. 1905.
(5) **Winchell, N. H.** *Report on the Geology of Auglaize County.* Report of the Geological Survey of Ohio. Vol. II, Geology and Palaeontology. Nevins and Meyers, State Printers, Columbus, Ohio. 1874.

Clouds and Weather Phenomena

The revised edition of this booklet, first published in 1926, contains 42 cloud photographs and a brief text of 24 pages. This little volume is likely to appeal to those who have more than passing interest in the more spectacular atmospheric phenomena such as cloud types, sunsets, rainbows, coronae and halos, and mirages. The author "has written for those not wishing to make a deep study of meteorological matter, yet who take an interest in the changing pageant of the sky."

Chinook winds, tornadoes, cyclones, northern lights, looming and lightning are some of the phenomena that could well have been included under the title without exceeding the author's objective of simplicity.—*John N. Wolfe.*

Clouds and Weather Phenomena, by C. J. P. Cave. Cambridge, at the University Press; New York, The Macmillan Co., $1.75.

A STUDY OF THE ASCORBIC ACID CONTENT OF THE DIET COMMONLY PRESCRIBED FOR PATIENTS WITH GASTRIC ULCERS[1]

MARGARET M. DUNNIGAN, MARTHA N. LEWIS AND M. R. SHETLER,
The Ohio State University Hospital and the Department of Agricultural Chemistry, The Ohio State University, Columbus, Ohio

The diet prescribed for patients suffering with gastric ulcer is one which must be followed over a period of months or years; therefore it is quite important that such a diet supply all of the essentials for good nutrition. A study of the literature reveals that, while special diet restrictions advised because of the presence of gastric ulcer have resulted in improvement of the ulcerous condition, these restrictions have in many cases resulted in definite deficiency states. It has long been recognized that the usual diets prescribed for gastric or duodenal ulcers are often deficient in ascorbic acid (7, 21). Cases have been reported (2, 5, 18, 22) of the development of scurvy in patients who followed such a diet. At present, moreover, it has been noted that early "prescorbutic" states in such cases are of frequent occurrence (1, 3, 8, 9, 10, 11, 13, 14, 15, 19). Further, the relationship of ascorbic acid to collagen formation (2, 3, 4) and consequently to wound healing (12), and to capillary fragility (6), may indicate that this vitamin is important in the healing of the ulcers although it is unlikely that ascorbic acid deficiency is a definite etiological factor in producing peptic ulcer in man (17, 19). Thus it would appear that the presence of a superimposed ascorbic acid deficiency state in patients with peptic ulcer would be extremely detrimental. Consequently this study was undertaken with two objects in view: first, to determine the ascorbic acid content of the ulcer diet as it was being served at the hospital; and second, to suggest a practical means of maintaining an adequate vitamin C intake in the diet of the ulcer patient.

PROCEDURE

The menu for the prescribed diet was written daily by the therapeutic dietitian and served from the floor diet kitchen in the usual manner. In general, the typical pattern of the diet was as follows:

BREAKFAST	LUNCH	SUPPER
Fruit	Protein Dish	Soup or Vegetable
Cereal with Cream and Sugar	Potato	Egg, Cottage Cheese
Egg	Vegetable	or Baked Potato
Toast with Butter	Toast with Butter	Toast with Butter
Milk	Dessert	Dessert
	Milk	Milk

At 10 A. M., 2 and 8 P. M., a glass of milk is given.

This diet is characterized by its bland and non-irritating foods. Any tender meats such as beef, lamb, chicken, ground or scraped beef, liver, tender fish or sweetbreads and cream or cottage cheese and eggs are given. Cereals as Farina, white or fine whole wheat bread, noodles, and rice are permitted. All coarse vegetables such as corn, green beans, peas, and lima beans are strained and other vegetables as potatoes, spinach, asparagus, carrots are given if well cooked. Orange, grapefruit, and tomato juices, soft stewed fruits, peaches, sieved pears, apricots,

[1]Condensed from a thesis submitted to the Graduate School in partial fulfillment of the requirements for the degree of Master of Science at The Ohio State University.

and prunes are allowed in addition to simple desserts as custard, junket, jello, ice cream, and sponge cake. Beverages such as milk and eggnog are used frequently, and weak coffee, cocoa, or chocolate milk are sometimes permitted. Each item of food was weighed as served and aliquot samples were collected. Analyses were made 15 to 20 minutes after each collection except for the supper meal, in which case metaphosphoric suspensions were made in the usual manner, placed in the refrigerator at 5° C., and the analyses completed the following morning.

The estimation of ascorbic acid was made by a modified Roe and Kuether method (20). This method gives directly a determination of the total ascorbic acid, and encounters no difficulties with pigmented food extracts.

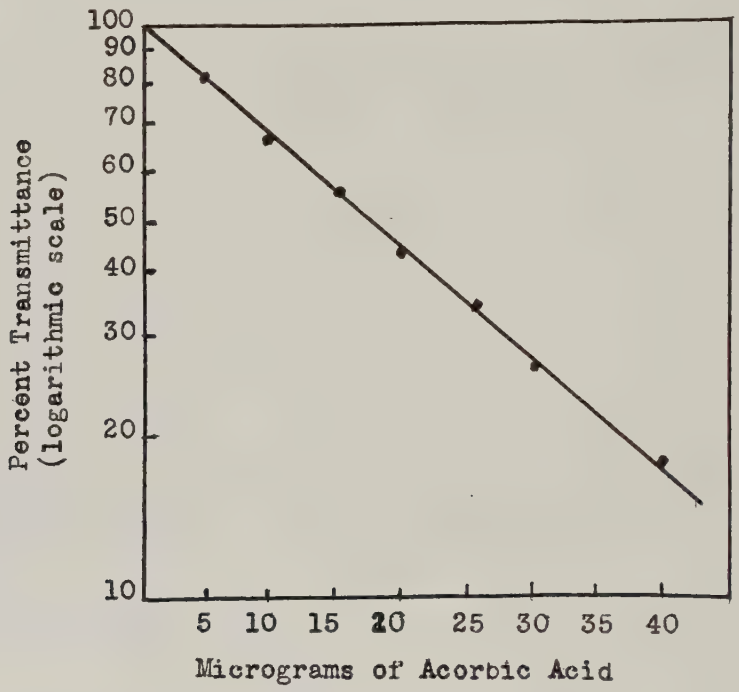


FIG. 1. Absorption Curve of 2, 4-dinitrophenonydrazine Derivative of Ascorbic Acid Using Reagent Blank as Reference Solution.

One to ten grams of the sample (a weight which when diluted properly would contain 5 to 40 gammas of ascorbic acid per milliliter) were weighed into the bowl of the Waring Blendor. Fifty or one hundred milliliters of 1% metaphosphoric acid were then added and the sample mixed at high speed for approximately three minutes. The mixture was transferred to a volumetric flask (100 ml. or 200 ml.) and made up to volume with 8% trichloroacetic acid. For each 100 cc. of the diluted sample approximately one teaspoonful (1.5 gm.) of acid washed norite was added and the mixture shaken vigorously.

Five cubic centimeters of the norite filtrate were placed in each of two matched photoelectric colorimeter tubes. When a volume smaller than 5 cc. was used, the quantity was made up to 5 cc. with 4% trichloroacetic acid. One drop of 10% thiourea solution was added to each tube. One tube was held in reserve for a blank and to the other tube 2 cc. of 2, 4-dinitrophenylhydrazine was added. The latter tube was placed in a water bath at 37° C. The bath was well equipped by thermostat to maintain a constant temperature. The tube was kept immersed

in the water bath for exactly three hours. It was removed and placed in a beaker of ice water containing generous quantities of ice. The blank tube was placed in the water also. To each of these tubes while in the ice water bath, were added very slowly 5 cc. of 85% sulphuric acid. The sulphuric acid was added from a burette a drop at a time, a step which required about one minute. It is very important not to allow the temperature of the solution to be raised appreciably, as this brings about a charring of the sugars or other organic matter and thus a positive error would be introduced. Finally, 1 cc. of 2, 4-dinitrophenylhydrazine was added to the blank tube. Both tubes were shaken thoroughly under the ice water to obtain complete mixing and were then removed to a rack. After thirty minutes the tubes were wiped clean and dry and read in a Coleman 10 S spectrophotometer using light with a wave length of 510 mu since in preliminary work an absorption curve (Fig. 1) showed an absorption band at 510–520.

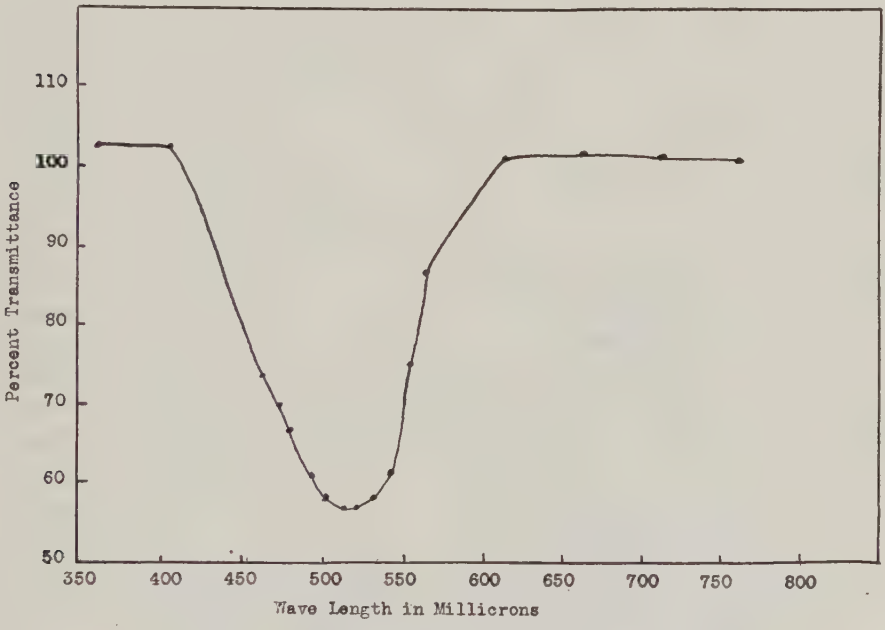


FIG. 2. Calibration Curve Made at 510 Millicrons.

A calibration curve was constructed using standard solutions of ascorbic acid varying from 5 to 40 gammas in 4% trichloroacetic acid. These solutions were treated with norite, filtered, and the determinations made in exactly the same way as described above. The readings of the known solutions were then plotted on semi-log paper, per cent transmittance against concentration (Fig. 2). Readings of the unknown solutions were determined, referred to the curve, and the ascorbic acid content computed.

In some cases simultaneous determinations on each item of food were made by a modified Tillman's (16) method; these results were found to agree closely with those obtained by the colorimetric method; however, in most cases, slightly higher results were obtained by the colorimetric method. This is to be expected since the colorimetric method gives an estimation of total ascorbic acid, while the method of Tillman determines only the reduced form. The vitamin C contents of individual foods as analyzed are recorded in Table I and the total ascorbic acid content of each day's diet for sixteen days are recorded in Table II.

TABLE I

VITAMIN C CONTENT OF FOODS ANALYZED

Food	Method of Preparation	Variety	No. of Times on Menu	Av. milligrams of Vitamin C per 100 grams
Apples	Steamed, unpeeled	Jonathan	1	3.1
	Sauce	Winesap	1	1.25
	Juice (commercially prepared)		1	0.00
Apricots	Juice (commercially canned)		2	0.00
Grapefruit	Juice (commercially) canned)		1	32.5
Lemons	Lemonade (1 pt. of lemon juice to 1 gal. of water)	California	2	7.80
	Pudding		1	0.00
Loganberries	Juice (commercially canned)		1	0.00
Pears	Commercially canned	Bartlett	3	1.49
Oranges	Juice (prepared the night before, sealed and placed in refrigerator)	Valencia	8	37.50
	Orangeade (approx. one-half orange juice and one-half water)	Valencia	2	16.00
Asparagus	Steamed to warm (commercially canned)		3	18.70
	Puree (commercially canned, then warmed when served)		1	15.0
	Soup (homemade, one-third asparagus puree and two-thirds milk)		1	4.38
Beets	Fresh, steamed, small, whole		2	2.40
	Whole, canned, steamed to warm		2	3.10
Carrots	Puree (canned, warmed before served)		2	5.30
	Strips, (fresh,steamed, then buttered)		2	3.05
	Cubes, (fresh, steamed, buttered)		1	2.8
Green Beans	Puree (commercially canned)		1	6.0
Peas	Puree (commercially canned, heated before serving)		2	5.75
	Soup (homemade, one-third pea puree, two-thirds milk)		2	2.95

TABLE I—(*Continued*)

Food	Method of Preparation	Variety	No. of Times on Menu	Av. milligrams of Vitamin C per 100 grams
Potato, Sweet..	Mashed	Nancy Hall	1	12.0
	Steamed, candied	Nancy Hall	1	19.5
Potato, White..	Steamed, unpeeled	Idaho	1	15.5
	Steamed, peeled, buttered	Red Russets	1	13.0
	Baked	Idaho Russet	4	11.31
	Escalloped	Red Russets	1	10.0
	Mashed	Red Russets	2	9.1
	Mashed	Bliss Triumphs	1	8.1
	Creamed	Bliss Triumphs	1	6.7
	Baked, stuffed	Idaho	1	2.2
Spinach	Soup (homemade, one-third spinach puree and two-thirds milk)		1	1.00
Squash	Mashed, frozen	Winter	2	7.29
Tomatoes	Juice (commerci'ly canned)		4	11.25
	Soup (commerci'ly canned)		1	3.55
	Soup (homemade, approx. two-thirds milk and one-third canned tomato puree)		2	4.38
Cream	Pasteurized		5	0.30
Ice Cream	Commercial (vanilla)		3	0.53
Liver	Baked	Beef	1	16.20
	Loaf (with mashed potato topping)	Beef	1	7.00
Milk	Pasteurized		5	1.57

TABLE II

ASCORBIC ACID IN THE DIET OF STOMACH ULCER PATIENTS

Day	Total Ascorbic Acid	Total Ascorbic Acid less Orange, Grapefruit and Tomato Juices	Total Ascorbic Acid less Orange, Grapefruit and Tomato Juice, plus 3 ounces of Orange Juice
1	152	25	60
2	99	41	76
3	125	41	76
4	34	38	73
5	142	39	74
6	75	43	78
7	64	50	85
8	40	41	76
9	31	30	65
10	89	48	83
11	142	56	91
12	61	39	74
13	39	43	78
14	45	49	84
15	100	36	71
16	117	48	83

DISCUSSION

Examination of Table II reveals that four days fell in the 25–40 milligram range, four days fell in the 40–75 milligram group and eight days reached the level 75–100 milligrams, usually considered necessary for body saturation. Also it may be noted that with the omission of orange, grapefruit and tomato juice (Table II) all of the days fell below the 60 milligram level. On the other hand, the addition of three ounces of orange juice to each day's diet would adequately correct this condition.

CONCLUSIONS

The amount of ascorbic acid furnished by the fruits and vegetables used in the ulcer diet other than orange, grapefruit or tomato can be relied upon to contribute only a small part of the daily need. From the results obtained, it can be seen that the required standard of ascorbic acid necessary for body saturation (75–100 milligrams) cannot be assured in the routine ulcer diet without the daily use of more than three ounces of orange juice, or its equivalent in other citrus fruit juices.

BIBLIOGRAPHY

(1) **Archer, H.** and **Graham, G.** The Subscurvy State in Relation to Gastric and Duodenal Ulcer. Lancet, 231: 364, 1936.
(2) **Barling, B.** Scurvy during Treatment for Gastric Ulcer. Brit. Med. J., 1: 358, 1935.
(3) **Bourne, G.** Vitamin C Deficiency in Peptic Ulceration Estimated by the Capillary Resistance Test. Brit. Med. J., 1: 560, 1938.
(4) **Dalldorf, G.** The Pathology of Vitamin C Deficiency. J. Am. Med. Assoc., 111: 1376, 1938.
(5) **Davidson, P.** The Development of Deficiency Disease During Therapeutic Diets. J. Am. Med. Assoc., 90: 1014, 1928.
(6) **Field, H., Robinson, W.,** and **Melnick, D.** Vitamins in Peptic Ulcers. Ann. Int. Med., 14: 588, 1940.
(7) **Green, C.** The Adequacy of Diets Used in the Treatment of Peptic Ulcer. J. Am. Dietet. A., 17: 570, 1941.
(8) **Harris, L. J.** A Programme for Nutrition Surveys. Lancet, 230: 966, 1936.
(9) **Harris, L. J., Abbasy, M. A., Ray, S. N.,** and **Marrack, J. R.** Diagnosis of Vitamin C Subnutrition by Urine Analysis. Lancet, 229: 1399, 1935.
(10) **Harris, L. J., Abbasy, M. A.** and **Yudkin, J.** The Vitamin C Reserves of Subjects of the Voluntary Hospital Class. Lancet, 230: 1488, 1936.
(11) **Ingalls, T.,** and **Warren, H.** Asymptomatic Scurvy, Its Relation to Wound Healing and Its Incidence in Patients with Peptic Ulcer. New Eng. J. M., 217: 443, 1937.
(12) **Lanman, T.** and **Ingalls, T.** Vitamin C Deficiency and Wound Healing. Ann. Surg., 105: 616, 1937.
(13) **Lazarus, S.** Vitamin C Nutrition in Cases of Haematemesis and Melaena. Brit. Med. J., 2: 1101, 1937.
(14) **Ludden, J., Flexner, J.,** and **Wright, I.** Studies on the Ascorbic Acid Deficiency in Gastric Disease, Incidence, Diagnosis and Treatment. Am. J. Digest. Dis. and Nutrition, 8: 249, 1941.
(15) **Lund, C.** Ascorbic Acid Deficiency Associated with Gastric Lesions. New Eng. J. M., 227: 247, 1942.
(16) **Mack, G. L.,** and **Tressler, D. K.** Vitamin C in Vegetables. A Critical Investigation of the Tillmans Method for the Determination of Ascorbic Acid. J. Biol. Chem., 118: 735, 1937.
(17) **McCarrison, R.** Some Surgical Aspects of Faulty Nutrition. Lancet, 220: 1151, 1931.
(18) **Platt, R.** Scurvy as a Result of Dietetic Treatment. Lancet, 231: 366, 1936.
(19) **Portnoy, B.,** and **Wilkinson, J.** Vitamin C Deficiency in Peptic Ulceration and Haematemesis. Brit. Med. J., 1: 554, 1938.
(20) **Roe, J. H.,** and **Kuether, C. A.** The Determination of Ascorbic Acid in Whole Blood and Urine Through the 2, 4 Dinitrophenylhydrazine Derivative of Dehydroascorbic Acid. J. Biol. Chem., 147: 399, 1943.
(21) **Troutt, L.** Quality Studies of Therapeutic Diets: The Ulcer Diet. J. Am. Dietet. A., 8: 25, 1932.
(22) **Wood, P.,** and **Melb, M. B.** A Case of Adult Scurvy. Lancet, 229: 1405, 1935.

LIST OF CHRYSOMELIDAE (COLEOPTERA) KNOWN TO OCCUR IN OHIO[1]

JOHN H. HUGHES,
University of Minnesota,
St. Paul, Minnesota

Specific investigation of the leaf beetles of the family *Chrysomelidae* was begun by the writer in June 1937 while a graduate student at Ohio University, Athens, Ohio. Records to July 1939, supplemented by data from other sources, were used in a Master's Thesis at Ohio University, Athens, Ohio, in August 1939 (unpublished). This list is based on the above mentioned data plus all records obtained by October 1940.

The family *Chrysomelidae*, which is world-wide in its distribution, is one of the largest known families of Coleoptera. Leng (1920) lists more than 1000 species and varieties for America north of Mexico. Records for 332 species and varieties for New York State are given by Leonard et al. (1926). Blatchley (1910) gives 266 species and varieties for Indiana. In 1902 and with additions in 1906, Dury published a list of Coleoptera of the Cincinnati Region (mainly Hamilton County) which included 163 species and varieties of *Chrysomelidae* for Ohio. This is the only other extensive published list for the State.

The present list records 298 species and varieties for Ohio, of which the writer has personally collected 192. Distribution records for other states indicate that an additional 112, for which we have no Ohio records at present, may occur in the state. Species are considered possible for Ohio when they have been reported from an adjacent state, from Western New York (Leonard et al., 1926) or when Ohio is located between two or more known points of occurrence. The total known and possible species and varieties for Ohio may be more than 400.

The synonymy and arrangement follow Leng (1920). The number of specimens of each species examined is given in parentheses. Records for species and varieties are given by counties. When the county is not known, "Ohio" is used instead. The earliest and latest known dates of the year on which each species was collected are recorded. When a record is based on published literature alone, it is accompanied by an explanatory note, except for some records taken from Dury (1902, 1906) in which case "Hamilton (CSNH)" is employed.

Abbreviations (in parentheses) for the sources of material are used as follows:

CM.....Cleveland Museum of Natural History, Cleveland, Ohio.
CSNH....Cincinnati Society of Natural History, Cincinnati, Ohio.
JHH.....Personal Collection of the Writer.
OSM.....Ohio State Museum, Columbus, Ohio.
OSU.....Ohio State University, Columbus, Ohio.
OU.....Ohio University, Athens, Ohio.
RML.....Ralph M. Leonard, Athens, Ohio.

When the abbreviations are accompanied by a question mark, the species is doubtfully recorded for that collection.

I wish to express my appreciation to Dr. William C. Stehr, Ohio University, Athens, Ohio, for guidance in this study and for use of the Ohio University collections. I am also grateful to Dr. John W. Aldrich, Cleveland Museum of Natural History; Mr. Ralph M. Dury, Cincinnati Society of Natural History; Mr. Edward S. Thomas, Ohio State Museum; Dr. J. N. Knull, Ohio State University; and to Mr. Ralph M. Leonard, Athens, Ohio, for making collections of *Chrysomelidae* available for this study.

[1]Paper No. 14 from the Department of Zoology, Ohio University, Athens, Ohio.

Family CHRYSOMELIDAE

Subfamily Donaciinae

Genus **Donacia** Fab.

D. piscatrix Lac. (39) Erie, Holmes, Licking, Vinton. May 30–Sept. 21. (JHH, OSM, OSU).
D. palmata Oliv. (9) Ashtabula, Erie, Morgan, Ottawa, Vinton. June–Sept. 21. (CSNH, JHH, OSU, OU).
D. hypoleuca Lac. (1) Erie, Knox. July–Aug. 6. (CM).
The Knox County record for July was taken from Schaeffer (1925).
D. cincticornis Newn. (26) Athens, Erie, Knox, Ottawa. May 25–Aug. 6. (OSM, OSU, OU).
D. proxima Kby. (6) Erie. July 11–Aug. 8. (OSU).
D. quadricollis Say (3) Erie. July 6–Aug. 1. (OSU).
D. subtilis Kunze (307) Auglaize, Erie, Fairfield, Fulton, Geauga, Hamilton, Jackson, Licking, Logan, Lucas, Medina, Ottawa, Pickaway, Portage, Summit, Vinton, Wayne. May 17–Sept. 23. (CM, CSNH, JHH, OSM, OSU, OU).
D. aequalis Say (8) Erie, Hamilton, Lawrence, Summit. April 24–July 5. (CSNH, OSM, OSU).
D. rufa Say (14) Hamilton, Hocking. April 17–May 30. (CSNH, OSU).
D. sulcicollis Lac. (32) Hamilton, Jackson, Medina, Summit. April 24–May 31. (CM, CSNH, JHH, OSM, OU).
D. flavipes Kby. (8) Champaign, Summit, Wayne. May 18–June 12. (CSNH, OSM, OSU).
D. metallica Ahr. (38) Cuyahoga, Hamilton, Medina, Summit. May 12–June 13. (CM, CSNH, OSM, OSU).
D. pusilla Say (5) Erie. July. (CSNH, OSU).
Other species of the Genus *Donacia* possible for Ohio: *D. texana* var. *minor* Schffr., *rufescens* Lac., *cincticornis* var. *tenuis* Schffr., *hirticollis* Kby., *pubescens* Lec., *rugosa* Lec., *biimpressa* Melsh., *biimpressa* var. *limonia* Schffr., *porosicollis* Lac., *subtilis* var. *fulgens* Lec., *tuberculifrons* Schffr., *megacornis* Blatch., *pubicollis* Schffr., *harrisi* Lec., *nitida* Germ., *emarginata* Kby., *diversa* Schffr., *wallisi* Schffr.

Subfamily Orsodacninae

Genus **Orsodacne** Latr.

O. atra (Ahr.) (20) Athens, Franklin, Gallia, Hamilton, Hocking, Jackson, Meigs, Summit, Wayne. Mar. 16–May 20. (CM, CSNH, OSM, OSU, OU).
O. atra var. **hepatica** Say (2) Cuyahoga, Hocking. May 9–May 16. (CM, OSU).
O. atra var. **trivittata** Lac. (1) Hamilton. (CSNH).
O. atra var. **vittata** Say (12) Athens, Gallia, Hocking, Jackson, Meigs. Mar. 17–May 20. (OSM, OSU, OU).

Genus **Syneta** Lac.

S. ferruginea (Germ.) (25) Athens, Clark, Greene, Hamilton, Hocking, Pickaway, Wayne. April 26–June 19. (CSNH, OSU, OU).

Genus **Zeugophora** Kunze

Species of the Genus *Zeugophora* possible for Ohio: *Z. kirbyi* Baly, *reineckei* Grote, *scutellaris* Suffr., *consanguinea* Cr., *varians* Cr.

Subfamily Criocerinae

Genus **Crioceris** Geoffr.

C. asparagi (L.) (221) Athens, Cuyahoga, Erie, Franklin, Guernsey, Hamilton, Hocking, Jackson, Ottawa, Perry. May 9–Sept. 24. (CM, CSNH, JHH, OSM, OSU, OU, RML).
C. duodecimpunctata (L.) (66) Ashtabula, Athens, Erie, Guernsey, Jackson, Lucas, Muskingum, Perry. May 19–Sept. 17. (CM, JHH, OSM, OSU, OU).

Genus **Lema** Fab.

L. brunnicollis Lac. (2) Fairfield, Franklin. May 11–July. (JHH, OSU).
L. collaris Say (16) Erie, Hamilton. May 30–July 10. (CSNH, OSU).
L. trilineata (Oliv.) (106) Adams, Ashtabula, Athens, Cuyahoga, Darke, Erie, Fairfield, Franklin, Hamilton, Hocking, Holmes, Jackson, Lake, Lucas, Meigs, Ottawa, Pickaway, Pike, Portage, Summit, Vinton, Washington. May 16–Oct. 9. (CM, CSNH, JHH, OSM, OSU, OU, RML).
L. sexpunctata Oliv. (264) Athens, Meigs. June 16–Nov. 10. (JHH, OU, RML).
L. sexpunctata var. **albini** Lac. (53) Athens, Meigs. June 14–Nov. 1. (JHH, OU, RML).
Other species of the Genus *Lema* possible for Ohio: *L. sayi* Cr., *palustris* Blatch.

Subfamily Clytrinae

Genus **Anomoea** Lac.

A. laticlavia Forst. (103) Athens, Fairfield, Franklin, Fulton, Hamilton, Hocking, Jackson, Lawrence, Licking, Logan, Lucas, Meigs, Morrow, Muskingum, Ottawa, Tuscarawas, Vinton. May 18–July 10. (CSNH, JHH, OSM, OSU, OU, RML).

Genus **Coscinoptera** Lac.

C. dominicana (Fab.) (73) Adams, Athens, Franklin, Gallia, Hamilton, Hocking, Jackson, Lawrence, Meigs, Vinton. May 19–Aug. 17. (CSNH, JHH, OSM, OSU, OU).

Genus **Babia** Lac.

B. quadriguttata (Oliv.) (97) Athens, Champaign, Clark, Franklin, Greene, Hamilton, Hocking. Jackson, Meigs, Ottawa, Scioto, Vinton. May 22–Oct. 19. (CSNH, JHH, OSM, OSU, OU).

Genus **Saxinis** Lac.

S. omogera Lac. (23) Adams, Athens, Gallia, Hamilton, Jackson, Lucas, Meigs, Vinton, May 22–Aug. 9. (CSNH, JHH, OSU, OU, RML).

Subfamily Fulcidacinae

Genus **Arthrochlamys** Ihering

A. gibbosa (Fab.) (73) Adams, Athens, Clark, Clermont, Cuyahoga, Fairfield, Franklin, Gallia, Greene, Hamilton, Hocking, Jackson, Lawrence, Medina, Meigs, Pike, Scioto, Vinton. May 1–Oct. 3. (CM, CSNH, JHH, OSM, OSU, OU, RML).

Other species of the Genus *Arthrochlamys* possible for Ohio: *A. cribripennis* Lec.

Genus **Exema** Lac.

E. gibber (Oliv.) (69) Adams, Athens, Champaign, Fairfield, Franklin, Hamilton, Jackson, Lawrence, Meigs, Morgan, Pike, Ross, Vinton. May 10–Oct. 13. (CSNH, JHH, OSM, OSU, OU, RML).

E. conspersa (Mann.) (3) Hamilton. June 12–June 27. (CSNH).

E. conspersa var. **dispar** Lac. (238) Adams, Ashland, Ashtabula, Athens, Cuyahoga, Gallia, Hamilton, Hocking, Jackson, Lawrence, Meigs, Pike, Portage, Scioto, Summit, Vinton. May 22–Sept. 26. (CM, CSNH, JHH, RML).

Subfamily Cryptocephalinae

Genus **Griburius** Hald.

G. larvatus (Newn.) Hamilton. (CSNH).

G. scutellaris (Fab.) (5) Fairfield, Hamilton, Jackson, Lucas, Vinton. June 9–July 7. (CSNH, JHH, OU).

G. equestris (Oliv.) (3) Hamilton, Lawrence. May 29. (CSNH, OSU). The Hamilton record by Charles Dury (CSNH) is given in Blatchley (1910).

Genus **Pachybrachys** Redt.

P. pubescens (Oliv.) (13) Hamilton, Hocking, Jackson. May 17–June 9. (CSNH, JHH, OSU).

P. lodingi Bowd. (1) Hamilton. (CSNH).

P. sobrinus Hald. (7) Athens, Hamilton, Lawrence, Meigs, Scioto. May 29–Aug. 26. (CSNH, JHH, OSU).

P. femoratus (Oliv.) (4) Athens, Lucas. June 23–July 7. (OU).

P. subfasciatus Lec. (24) Athens, Clark, Greene, Hamilton, Hocking. May 14–July 2. (CSNH, JHH, OSU, OU).

P. atomarius (Melsh.) (40) Athens, Hamilton, Hocking, Jackson, Vinton. May 22–Aug. 17. (CSNH, JHH, OU).

P. roboris Fall (2) Hamilton. June 27–July 7. (CSNH).

P. spumarius Suffr. (1) Athens. July 9. (JHH).

P. tridens (Melsh.) (31) Athens, Auglaize, Fairfield, Hamilton, Vinton. May 22–Aug. 17. (CSNH, JHH).

P. bivittatus (Say) (53) Athens, Cuyahoga, Erie, Franklin, Hamilton, Jackson, Lake, Licking, Ottawa, Preble, Washington. May 18–Sept. 21. (CM, CSNH, JHH, OSM, OSU).

P. litigiosus Suffr. (8) Athens, Jackson, Vinton. June 16–July 21. (JHH).

P. othonus (Say) (18) Ashland, Athens, Cuyahoga, Gallia, Hamilton, Jackson, Summit, Vinton, Warren, Wood. June 4–July 24. (CM, CSNH, JHH, OSU, OU).

P. carbonarius Hald. (2) Athens, Hocking. June 7–June 28. (JHH, OSM).
P. viduatus (Fab.) (1) Hamilton. (CSNH).
P. m-nigrum (Melsh.) (2) Lawrence, Vinton. Aug. 17–Aug. 23. (JHH).
P. trinotatus (Melsh.) (48) Athens, Cuyahoga, Fairfield, Gallia, Geauga, Hamilton, Jackson, Meigs, Portage, Vinton. June 29–Sept. 4. (CM, CSNH, JHH, OU).
P. confusus Bowd. (16) Athens, Hocking, Jackson, Vinton. July 4–Aug. 19. (JHH).
P. luridus (Fab.) (14) Athens, Hamilton, Jackson, Lucas, Meigs, Vinton, Wood. May 30–July 7. (CM, CSNH, JHH, OU, RML).
P. luridus var. **nigrinus** Blatch. (1) Ashland. June 24. (CM).
P. dilatatus Suffr. (8) Athens, Fairfield, Hamilton, Jackson, Meigs. May 18–July 2. (CSNH, JHH, OU).
P. hepaticus (Melsh.) (14) Athens, Hamilton, Jackson, Warren. June 10 to 12–July 7. (CSNH, JHH).

Other species of the Genus *Pachybrachys* possible for Ohio: *P. abdominalis* (Say), *pectoralis* (Melsh.), *calcaratus* Fall, *peccans* Suffr., *tridens* var. *flavicornis* (Melsh.), *obsoletus* Suffr., *praeclarus* Weise, *autolycus* Fall, *autolycus* var. *difficilis* Fall, *pulvinatus* Suffr.

Genus **Monachulus** Leng

M. ater (Hald.) (43) Athens, Fairfield, Fulton, Gallia, Hamilton, Hocking, Jackson, Lawrence, Vinton. June 10–Sept. 3. (CSNH, JHH, OSU).
M. saponatus (Fab.) (89) Athens, Erie, Gallia, Hamilton, Hocking, Jackson, Lawrence, Lucas, Madison, Vinton. June 16–Sept. 3. (CSNH, JHH, OSU, OU).
M. guerini (Perbosc.) Hamilton. (CSNH).

Genus **Cryptocephalus** Geoffr.

C. notatus var. **quadrimaculatus** Say (36) Athens, Franklin, Hamilton, Hocking, Jackson, Lawrence, Meigs, Warren. May 15–July 25. (CSNH, JHH, OSM, OSU, OU, RML).
C. quadruplex Newn. (84) Adams, Ashland, Athens, Champaign, Cuyahoga, Darke, Franklin, Hamilton, Hocking, Jackson, Lucas, Ottawa, Vinton. May 25–Sept. 5. (CM, CSNH, JHH, OSM, OSU, OU, RML).
C. quadruplex var. **quadriguttulus** Suffr. (18) Athens, Erie, Hamilton, Licking. May 15–Aug. 19. (CSNH, OSU, OU).
C. guttulatus Oliv. (9) Adams, Athens, Hamilton, Hocking. June 13–Oct. 12. (CSNH, OSU, OU).
C. leucomelas Suffr. (41) Adams, Athens, Fairfield, Franklin, Hamilton, Jackson, Lucas, Montgomery, Ross, Scioto. June 21–Sept. 12. (CSNH, JHH, OSM, OSU, OU).
C. venustus Fab. (77) Adams, Ashland, Athens, Champaign, Gallia, Hamilton, Hocking, Jackson, Lawrence, Morgan, Ottawa, Pike, Scioto, Summit, Vinton, Warren. June 10 to 12–Sept. 3. (CM, CSNH, JHH, OSM, OSU, OU).
C. venustus var. **cinctipennis** Rand. (16) Ashland, Ashtabula, Athens, Auglaize, Hamilton, Hocking, Jackson, Ottawa, Vinton. June 19–Aug. 20. (CM, CSNH, JHH, OSU, OU).
C. venustus var. **hamatus** Melsh. (18) Ashland, Athens, Erie, Fairfield, Hamilton, Jackson, Lake, Medina, Pike, Vinton. Feb. 10–Sept. 3. (CM, CSNH, JHH, OSU, OU).
C. venustus var. **simplex** Hald. (38) Adams, Ashland, Athens, Gallia, Hamilton, Jackson, Lawrence, Meigs, Morgan, Vinton. June 5–Sept. 3. (CM, CSNH, JHH, OSU).
C. incertus Hald. (1) Hamilton. June 20. (CSNH).
C. trivittatus Oliv. (1) Athens. July 24. (OU).
C. mutabilis Melsh. (42) Adams, Athens, Erie, Fairfield, Franklin, Fulton, Hamilton, Hocking, Lawrence, Lorain, Lucas, Meigs, Vinton. June 12–Oct. 12. (CSNH, JHH, OSM, OSU).
C. badius Suffr. (13) Athens, Gallia, Hamilton, Pike. June 22–Aug. 18. (CSNH, JHH).
C. schreibersi Suffr. (5) Hocking. Oct. 10–Oct. 14. (OSU).
C. tinctus Lec. (4) Athens, Jackson, Lawrence. Aug. 16–Oct. 25. (JHH, OU).

Other species of the Genus ***Cryptocephalus*** possible for Ohio: *C. basalis* Suffr., *striatulus* Lec.

Genus **Diachus** Lec.

D. auratus (Fab.) (14) Adams, Athens, Fairfield, Hamilton, Lawrence, Meigs, Pike. June 4–Aug. 26. (CSNH, JHH).
D. pallidicornis (Suffr) (5) Hamilton. May 23–June 4. (CSNH).
D. chlorizans (Suffr.) (15) Hamilton, Jackson, Pike, Vinton. July 3–Aug. 19. (CSNH, JHH).

Other species of the Genus *Diachus* possible for Ohio: *D. laevis* (Hald.), *aeruginosus* Lec., *catarius* (Suffr.).

Genus **Bassareus** Hald.

B. brunnipes (Oliv.) (3) Adams, Cuyahoga, Hamilton. June 26–Aug. 8. (CM, CSNH?, OSU).
B. clathratus Melsh. (47) Athens, Hocking, Jackson, Lawrence, Ross, Vinton. June 8–Sept. 3. (JHH, RML).

B. formosus (Melsh.) (20) Adams, Athens, Gallia, Hamilton, Hocking, Jackson, Pike, Scioto, Vinton. June 16–Aug. 27. (CSNH, JHH, OSM, OU).
B. formosus var. **sulphuripennis** (Melsh.) (3) Champaign, Lucas. July 7–July 27. (OSM, OU).
B. detritus (Oliv.) (1) Hamilton, Jackson. Sept. 3. (CSNH, JHH).
B. mammifer (Newn.) (20) Athens, Clark, Erie, Greene, Hamilton, Hocking, Portage. June 14–Aug. 4. (CSNH, JHH, OSM, OSU).
B. mammifer var. **sellatus** Suffr. (14) Athens, Hamilton, Pickaway, Vinton. June 4–Aug. 27. (CSNH, JHH, OSM).
B. lituratus (Fab.) (2) Lawrence. May 26–May 29. (OSU).
B. lituratus var. **castus** (Melsh.) (5) Jackson. May 22–June 26. (JHH).
B. lituratus var. **lativittis** (Germ.) (11) Athens, Hamilton, Warren. June 10 to 12–July 7. (CSNH, JHH).
B. lituratus var. **recurvus** Say. (16) Hamilton. May 21–June 19. (CSNH).
B. lituratus var. **niger** Blatch. (10) Jackson, Licking, Vinton. May 20–June 26. (JHH, OSU).

Genus **Triachus** Lec.

Species of the Genus *Triachus* possible for Ohio: *T. atomus* (Suffr.), *vacuus* Lec.

Subfamily Eumolpinae

Genus **Chrysodina** Baly

C. globosa (Oliv.) (6) Athens, Gallia, Hocking. May 17–July 21. (JHH, OSU).

Genus **Nodonota** Lef.

N. tristis (Oliv.) (337) Adams, Ashtabula, Athens, Clermont, Fairfield, Franklin, Gallia, Hamilton, Hocking, Jackson, Lawrence, Licking, Lucas, Meigs, Pike, Ross, Scioto, Summit, Vinton, Washington. June 5–Oct. 20. (CSNH, JHH, OSM, OSU, OU).
N. clypealis Horn. (241) Adams, Athens, Fairfield, Hamilton, Jackson, Lawrence, Meigs, Pike, Scioto, Vinton, Washington. June 5–Sept. 1. (CSNH, JHH, OU).
N. convexa (Say) (1) Guernsey, Hamilton. Aug. 19. (CSNH, OSU).
N. puncticollis (Say) (1101) Athens, Hamilton, Hocking, Holmes, Jackson, Lucas, Vinton. May 29–Oct. 20. (CSNH, JHH, OSM, OSU, OU, RML).

Genus **Colaspis** Fab.

C. brunnea (Fab.) (254) Adams, Ashtabula, Athens, Cuyahoga, Fairfield, Franklin, Gallia, Holmes, Jackson, Lawrence, Lucas, Meigs, Pike, Ross, Vinton, Washington. June 10–Aug. 29. (CM, CSNH, JHH, OSM, OSU, OU, RML).
C. brunnea var. **flavida** Say. (1) Lucas. July 7. (OU).
C. brunnea var. **suilla** Fab. (4) Fulton. June 24. (OSU).

Genus **Rhabdopterus** Lef.

R. picipes (Oliv.) (43) Ashtabula, Athens, Gallia, Hamilton, Hocking, Holmes, Jackson, Lawrence, Meigs, Vinton. May 2–Oct. 4. (CSNH, JHH, OSM, OSU, OU, RML).

Genus **Graphops** Lec.

C. varians Lec. (1) "Ohio." (CSNH).
G. pubescens (Melsh.) (7) Adams, Athens, Hamilton, Jackson. May 16–Aug. 29. (CSNH, JHH, OU).
G. curtipennis (Melsh.) (1) Scioto. Aug. 29. (JHH).
G. marcassitus Cr. (6) Adams, Athens, Hamilton, Jackson. May 30–Aug. 26. (CSNH, JHH, OU).
G. nebulosus (Lec.) (2) Hamilton, Lawrence. June 1–June 25. (CSNH, OSU).

Genus **Xanthonia** Baly

X. decemnotata (Say) (48) Athens, Geauga, Hamilton, Hocking, Jackson, Lawrence, Madison, Vinton. May 20–Nov. 19. (CM, CSNH, JHH, OSU, OU, RML).
X. villosula (Melsh.) (29) Athens, Erie, Franklin, Hamilton, Lucas, Ottawa, Vinton. June 15–Aug. 17. (CSNH, JHH, OSM, OSU, OU).

Genus **Fidia** Baly

F. viticida Walsh (15) Adams, Athens, Erie, Lawrence, Ottawa. June 26–Aug. 26. (CSNH, JHH, OSU, OU, RML).
F. longipes (Melsh.) (12) Athens, Cuyahoga, Highland, Hocking, Meigs. May 15–July 28. (CM, CSNH, JHH, OSU, OU).

Genus **Metachroma** Lec.

M. angustulum Cr. (24) Erie. June 30–July 15. (OSU).
M. pallidum (Say) Hamilton. (CSNH).

Other species of the Genus *Metachroma* possible for Ohio: *M. interruptum* (Say), *parallelum* Horn, *quercatum* (Fab.).

Genus **Adoxus** Kby.

Species of the Genus *Adoxus* possible for Ohio: *A. obscurus* (L.).

Genus **Tymnes** Chap.

T. tricolor (Fab.) (37) Athens, Cuyahoga, Geauga, Hamilton, Hocking, Perry, Portage, Vinton. May 29–Aug. 15. (CM, CSNH, OSM, OSU, OU, RML).
T. violaceus Horn (1) Scioto. May 24. (OSM).
T. metasternalis Cr. (28) Athens, Champaign, Clark, Franklin, Gallia, Greene, Hamilton, Hocking, Madison. May 2–July. (CSNH, JHH, OSM, OSU, OU).

Genus **Myochrous** Er.

M. denticollis (Say) (4) Athens, Gallia, Hamilton. Mar. 24–Aug. 11. (CSNH, JHH, OU).

Genus **Glyptoscelis** Lec.

G. pubescens (Fab.) (8) Hocking. May 9–June 14. (OSU).
G. barbata (Say) (13) Athens, Clark, Greene, Hamilton, Hocking. May 22–Sept. 10. (CSNH, OSM, OSU, RML).
G. cryptica (Say) (1) Hamilton. May 20. (CSNH).

Other species of the Genus *Glyptoscelis* possible for Ohio: *G. liebecki* Blatch.

Genus **Typophorus** Er.

T. viridicyaneus (Cr.) (50) Adams, Fairfield, Hamilton, Jackson, Pike, Ross, Vinton, Washington. June 9–Aug. 29. (CSNH, JHH, OSM).

Genus **Paria** Lec.

P. canella var. **aterrima** (Oliv.) (50) Ashtabula, Athens, Cuyahoga, Fairfield, Hamilton, Hocking, Jackson, Meigs, Scioto, Vinton. April 17–Aug. 29. (CSNH, JHH, OSU, OU, RML).
P. canella var. **gilvipes** Horn (70) Adams, Ashtabula, Athens, Auglaize, Champaign, Clark, Fairfield, Franklin, Gallia, Greene, Hamilton, Hocking, Jackson, Licking, Ottawa, Pike, Vinton, Washington. Mar. 20–Nov. 22. (CSNH, JHH, OSM, OSU, OU, RML).
P. canella var. **pumila** Lec. (19) Adams, Ashtabula, Athens, Champaign, Hamilton, Hocking, Jackson, Lawrence, Meigs, Ross. April 24–Sept. 14. (CSNH, JHH, OSU, RML).
P. canella var. **quadriguttata** Lec. (35) Adams, Athens, Jackson, Lucas, Meigs, Ross, Vinton, Washington. April 28–Aug. 29. (JHH, OU).
P. canella var. **quadrinotata** (Say) (71) Adams, Ashtabula, Athens, Fairfield, Franklin, Gallia, Hamilton, Hocking, Jackson, Lawrence, Licking, Logan, Meigs, Pickaway, Ross, Summit, Vinton, Washington. April 22–Oct. 15. (CSNH, JHH, OSM, OSU, OU, RML).
P. canella var. **sellata** Horn (30) Adams, Ashtabula, Franklin, Gallia, Hamilton, Jackson, Lucas, Ross, Vinton, Washington. Mar. 25–Aug. 29. (CSNH, JHH, OSU, OU).
P. canella var. **sexnotata** (Say) (12) Champaign, Clark, Greene, Hamilton, Montgomery, Ross. April 27–Aug. 29. (CSNH, JHH, OSU).
P. canella var. **thoracica** (Melsh.) (205) Adams, Ashtabula, Athens, Auglaize, Cuyahoga, Franklin, Gallia, Hamilton, Hocking, Jackson, Lawrence, Lucas, Meigs, Montgomery, Pike, Ross, Scioto, Vinton, Washington, Wayne. May 24–Sept. 3. (CM, CSNH, JHH, OSM, OSU, OU, RML).
P. canella var. **vittata** Horn (7) Adams, Ashtabula, Athens, Jackson, Ross, Washington. May 15–Aug. 29. (CSNH, JHH, OU).

Other species of the Genus *Paria* possible for Ohio: *P. canella* var. *scutellaris* Notm., *canella* var. *opacicollis* Lec., *juniperi* Blatch.

Genus **Chrysochus** Redt.

C. auratus (Fab.) (424) Adams, Ashtabula, Athens, Auglaize, Cuyahoga, Erie, Fairfield, Franklin, Gallia, Geauga, Guernsey, Hamilton, Highland, Hocking, Jackson, Lawrence, Licking, Lucas, Meigs, Ottawa, Pike, Ross, Scioto, Vinton, Washington. June 8–Sept. 19. (CM, CSNH, JHH, OSM, OSU, OU, RML).

Subfamily Chrysomelinae

Genus **Prasocuris** Latr.

P. obliquata Lec. (2) Franklin, Hamilton. May 29. (CSNH, OSU).

Other species of the Genus *Prasocuris* possible for Ohio: *P. phellandrii* (L.), *vittata* (Oliv.), *ovalis* Blatch.

Genus **Labidomera** Chev.

L. clivicollis (Kby.) (71) Adams, Ashtabula, Athens, Clermont, Crawford, Cuyahoga, Erie, Fairfield, Franklin, Hamilton, Jackson, Lake, Licking, Lucas, Meigs, Miami, Ottawa, Pike, Ross, Summit. Jan. 11–Nov. 1. (CM, CSNH, JHH, OSM, OSU, OU, RML).

Genus **Leptinotarsa** Stal

L. decemlineata (Say) (197) Adams, Ashtabula, Athens, Cuyahoga, Erie, Franklin, Hamilton, Jackson, Knox, Meigs, Monroe, Ottawa, Portage, Sandusky, Washington. April 14–Oct. 11. (CM, CSNH, JHH, OSM, OSU, OU, RML).

L. juncta (Germ.) (229) Adams, Athens, Gallia, Hamilton, Hocking, Jackson, Lawrence, Meigs, Pike, Ross, Scioto, Washington. Mar. 29–Oct. 24. (CSNH, JHH, OSM, OSU, OU, RML).

Genus **Zygogramma** Chev.

Z. suturalis (Fab.) (549) Adams, Ashtabula, Athens, Clark, Cuyahoga, Erie, Fairfield, Franklin, Gallia, Geauga, Greene, Hamilton, Hocking, Jackson, Lake, Lawrence, Licking, Logan, Marion, Medina, Meigs, Perry, Pike, Portage, Scioto, Summit, Vinton. April 14–Oct. 2. (CM, CSNH, JHH, OSM, OSU, OU, RML).

Z. suturalis var. **casta** Rogers (20) Adams, Athens, Cuyahoga, Darke, Erie, Gallia, Hamilton, Jackson, Lawrence, Licking, Pike. May 8–Sept. 3. (CM, CSNH, JHH, OSM, OSU).

Genus **Calligrapha** Er.

C. lunata (Fab.) (1) Lucas. July 20. (OSM).

C. similis Rogers (27) Athens, Cuyahoga, Hamilton, Hocking, Jackson, Licking, Pike. May 12–Oct. 4. (CM, CSNH, JHH, OSM, OSU, OU, RML).

C. praecelsis Rogers (10) Franklin, Hamilton, Pike. May 9–Aug. 18. (CSNH, JHH, OSM, OSU).

C. elegans (Oliv.) (22) Ashtabula, Cuyahoga, Franklin, Fulton, Hamilton, Holmes. April–Sept. 6. (CM, CSNH, JHH, OSM, OSU).

C. scalaris Lec. (16) Erie, Fairfield, Hamilton, Hocking, Holmes, Jackson, Licking, Ottawa. May–Oct. 2. (CSNH, JHH, OSM, OSU).

C. philadelphica (L.) (12) Champaign, Hocking, Jackson, Licking, Lucas, Scioto. May 18–Sept. 14. (JHH, OSM, OU).

C. multipunctata (Say) (8) Ashtabula, Cuyahoga, Hamilton, Summit. May 21–Aug. 6. (CM?, CSNH).

C. multipunctata var. **bigsbyana** (Kby.) (96) Adams, Ashtabula, Athens, Champaign, Cuyahoga, Erie, Franklin, Hamilton, Highland, Huron, Jackson, Lake, Lucas, Meigs, Ottawa, Ross, Summit, Vinton, Washington, Williams. April 26–Oct. 22. (CM, CSNH, JHH, OSM, OSU, OU, RML).

C. multiguttata Stal Hamilton. (CSNH).

Other species of the Genus *Calligrapha* possible for Ohio: *C. rhoda* var. *walshiana* Blatch., *rowena* Knab.

Genus **Chrysolina** Mots.

C. flavomarginata (Say). Van Dyke (1938) examined this species from Ohio (Leng Coll.).

Other species of the Genus *Chrysolina* possible for Ohio: *C. auripennis* (Say), *subopaca* (Rogers).

Genus **Plagiodera** Redt.

Species of the Genus *Plagiodera* possible for Ohio: *P. versicolora* (Laich.).

Genus **Phaedon** Latr.

P. viridis (Melsh.) (2) Ashtabula. April. (CSNH).

Genus **Gastroidea** Hope

G. polygoni (L.) (7) Ashtabula, Auglaize, Franklin, Hamilton, Licking. April 26–Sept. 20. (CSNH, OSM, OSU).

G. cyanea Melsh. (127) Adams, Ashtabula, Athens, Fairfield, Franklin, Hamilton, Jackson, Meigs, Perry, Portage, Vinton. April 18–Aug. 20. (CM, CSNH, JHH, OSM, OSU, OU, RML).

G. cyanea var. **caesia** Rogers (3) Ashtabula, Hamilton. June 1. (CSNH, OSU).

Genus **Lina** Meg.

L. interrupta Fab. (811) Ashland, Ashtabula, Athens, Auglaize, Clermont, Cuyahoga, Erie, Fairfield, Franklin, Hamilton, Hocking, Holmes, Jackson, Licking, Logan, Lucas, Meigs, Montgomery, Morgan, Ottawa, Portage, Sandusky, Summit, Vinton, Washington. April 1–Oct. 30. (CM, CSNH, JHH, OSM, OSU, OU, RML).
L. tremulae (Fab.) (2) Ashland, Ashtabula. June 22. (OSU).
L. scripta (Fab.) (71) Adams, Ashtabula, Athens, Erie, Fairfield, Franklin, Hamilton, Lake, Licking, Lucas, Ottawa, Ross, Vinton, Washington. June 7–Aug. 29. (CSNH, JHH, OSM, OSU, OU).
L. scripta var. **confluens** Rogers (2) Lucas. July 7. (OU).
L. obsoleta Say (1) Lucas. May 5. (OSM).

Genus **Phytodecta** Kby.

Species of the Genus *Phytodecta* possible for Ohio: *P. americana* Schffr.

Genus **Phyllodecta** Kby.

P. vulgatissima (L.) Listed for Ohio by Leng (1920).
P. americana var. **pallipes** Schffr. Listed for Ohio by Leng (1920).

Other species of the Genus *Phyllodecta* possible for Ohio: *P. vitellinae* (L.), *americana* Schffr.

Subfamily Galerucinae

Genus **Halticidea** Horn

H. externa (Say) (2) Hamilton. June 13. (CSNH, OSU).

Genus **Trirhabda** Lec.

T. virgata Lec. (147) Cuyahoga, Erie, Fairfield, Franklin, Hamilton, Huron, Jackson, Lake, Ottawa, Summit. June 26–Sept. 20. (CM, CSNH, JHH, OSM, OSU, OU).
T. canadensis (Kby.) (19) Cuyahoga, Erie, Lucas, Ottawa. June 12–Aug. 15. (JHH, OSU, OU).

Other species of the Genus *Trirhabda* possible for Ohio: *T. borealis* Blake.

Genus **Galerucella** Cr.

G. americana (Fab.) (3) Adams. Aug. 26. (JHH).
G. cribrata (Lec.) (211) Ashtabula, Athens, Champaign, Clark, Darke, Fairfield, Gallia, Greene, Hocking, Jackson, Lake, Lawrence, Lucas, Meigs, Pike, Portage, Ross, Vinton. May 8–Oct. 13. (CM, JHH, OSM, OSU, OU, RML).
G. sexvittata (Lec.) (323) Athens, Gallia, Hamilton, Jackson, Meigs, Pike, Portage, Vinton. May 19–Sept. 24. (CM, CSNH, JHH, OU, RML).
G. cavicollis (Lec.) (18) Ashtabula, Lucas, Ross, Vinton, Washington. June 2–Aug. 29. (JHH, OSU, OU).
G. rufosanguinea (Say) (1) Portage. July 30. (CM).
G. integra (Lec.) (3) Athens, Erie, Lucas. July 20–Oct. 1. (OSM, OSU, OU).
G. notulata (Fab.) (47) Adams, Athens, Gallia, Hamilton, Jackson, Lawrence, Meigs, Pike, Scioto, Vinton. June 23–Sept. 24. (CSNH, JHH).
G. notata (Fab.) (34) Ashtabula, Athens, Erie, Fairfield, Franklin, Hocking, Jackson, Medina, Portage, Vinton. Mar. 25–Sept. 24. (CM, JHH, OSM, OSU, OU, RML).
G. nymphaeae (L.) (231) Ashtabula, Hamilton, Jackson, Licking, Portage, Sandusky, Vinton. May 3–Sept. 21. (CM, CSNH, JHH, OSM, OSU).
G. tuberculata (Say) Hamilton. (CSNH).
G. decora (Say) (4) Hamilton, Portage. May 3–Aug. 16. (CM, CSNH).
G. luteola Mull. (39) Butler, Franklin, Hamilton, Montgomery. Aug. 22–Sept. 18. (CSNH, OSM, OSU).

Genus **Paratriarius** Schffr.

P. dorsata (Say) (36) Hamilton. June 24–Aug. 2. (CSNH, OSU).

Genus **Diabrotica** Chev.

D. duodecimpunctata (Fab.) (573) Adams, Ashtabula, Athens, Cuyahoga, Erie, Fairfield, Franklin, Gallia, Hamilton, Highland, Hocking, Holmes, Jackson, Lake, Lawrence, Licking, Lucas, Madison, Meigs, Monroe, Ottawa, Pike, Portage, Ross, Scioto, Stark, Vinton, Washington. Feb. 7–Nov. 12. (CM, CSNH, JHH, OSM, OSU, OU, RML).
D. longicornis (Say) (104) Athens, Coshocton, Cuyahoga, Franklin, Hamilton, Jackson, Meigs, Pickaway, Ross, Washington. July 12–Oct. 7. (CM, CSNH, JHH, OSU, OU).
D. atripennis (Say) (6) Adams, Madison. June 7–Aug. 26. (JHH, OSU).
D. vittata (Fab.) (292) Adams, Ashtabula, Athens, Auglaize, Cuyahoga, Fairfield, Franklin, Gallia, Hamilton, Hocking, Jackson, Meigs, Monroe, Pickaway, Pike, Putnam, Ross, Summit, Vinton. April 7–Nov. 7. (CM, CSNH, JHH, OSM, OSU, OU, RML).

Genus **Phyllobrotica** Redt.

P. decorata (Say) (2) Clark, Greene, Lucas. June 3–June 25. (OSM, OSU).
P. discoidea (Fab.) (1) Franklin, Hamilton. (CSNH, OSU).
P. limbata (Fab.) (25) Ashtabula, Athens, Hamilton, Hocking, Jackson, Lucas, Vinton. June 6–July 8. (CSNH, JHH, OSM, OSU, OU).

Other species of the Genus *Phyllobrotica* possible for Ohio: *P. vittata* Horn, *lengi* Blatch., *stenides* Schffr.

Genus **Luperodes** Mots.

L. meraca (Say) (21) Ashtabula, Athens, Hocking, Holmes, Jackson, Vinton. May 1–July 2. (JHH, OSM, OSU).
L. cyanellus Lec. (12) Athens, Gallia, Wayne. May 10–June 13. (CSNH, OSU, OU, RML).

Other species of the Genus *Luperodes* possible for Ohio: *L. thoracicus* (Melsh.).

Genus **Phyllecthrus** Lec.

P. gentilis Lec. (20) Athens, Gallia, Guernsey, Jackson, Lawrence, Meigs. May 30–June 24. (CSNH, JHH, OSU, OU, RML).
P. dorsalis (Oliv.) (1) Athens. June 9. (OU).

Genus **Galeruca** Geoffr.

G. pomonae Scop. (3) Athens, Hamilton, Hardin. May 20–Sept. 10. (CSNH, OSM, OU).

Genus **Cerotoma** Chev.

C. trifurcata (Forst.) (165) Adams, Athens, Champaign, Cuyahoga, Fairfield, Franklin, Gallia, Hamilton, Hocking, Jackson, Lawrence, Marion, Medina, Meigs, Pike, Portage, Ross, Scioto, Vinton, Washington. May 1–Nov. 3. (CM, CSNH, JHH, OSM, OSU, OU, RML).

Subfamily Halticinae

Genus **Blepharida** Rogers

B. rhois (Forst.) (640) Adams, Athens, Clermont, Coshocton, Fairfield, Franklin, Gallia, Hamilton, Hocking, Jackson, Knox, Lawrence, Licking, Lucas, Medina, Meigs, Pike, Scioto, Vinton. May 8–Oct. 18. (CM, CSNH, JHH, OSM, OSU, OU, RML).

Genus **Pachyonychus** Chev.

P. paradoxus Melsh. (10) Hamilton, Hocking, Jackson, Lawrence. May 22–June 9. (CSNH, JHH, OSU, OU).

Genus **Hypolampsis** Clark

H. pilosa (Ill.) (7) Hamilton, Jackson, Washington. July 2–July 12. (CSNH, JHH, OSU).

Genus **Oedionychis** Latr.

Oe. gibbitarsa (Say) (43) Athens, Clark, Erie, Fairfield, Franklin, Hamilton, Holmes, Jackson, Meigs. May 2–Oct. 10. (CSNH, JHH, OSM, OSU, OU, RML).
Oe. thoracica (Fab.) (16) Adams, Athens, Erie, Hamilton, Hocking, Vinton. April 25–Sept. 24. (CSNH, JHH, OSM, OSU, OU).
Oe. vians (Ill.) (24) Ashtabula, Athens, Franklin, Hamilton, Hocking, Jackson, Lawrence, Licking, Meigs. Feb. 10–Oct. 18. (CSNH, JHH, OSU, OU, RML).
Oe. fimbriata (Forst.) (12) Athens, Hocking, Jackson. Feb. 10–July 31. (JHH, OSM, OU, RML).
Oe. petaurista (Fab.) (2) Athens, Hamilton. June 17–Oct. 1. (CSNH, OU).
Oe. miniata (Fab.) (4) Hocking, Jackson, Lawrence. June 1–July 4. (JHH, OSM).
Oe. thyamoides Cr. (20) Athens, Franklin, Gallia, Hamilton, Vinton, Warren. May 2–Dec. 30. (CSNH, JHH, OSU, OU).
Oe. subvittata Horn (31) Ashtabula, Athens, Cuyahoga, Fulton, Hamilton, Jackson, Meigs, Scioto, Summit, Vinton, Wayne. April 8–Oct. 25. (CM, CSNH, JHH, OSU, OU).
Oe. sexmaculata (Ill.) (21) Athens, Clark, Gallia, Greene, Hamilton, Scioto, Vinton. April 28–Aug. 29. (CSNH, JHH, OSU, OU, RML).
Oe. quercata (Fab.) (52) Athens, Fairfield, Franklin, Gallia, Hocking, Holmes, Jackson, Pike, Scioto, Summit, Vinton. April 27–Aug. 27. (CM, JHH, OSM, OSU, OU).
Oe. scalaris Melsh. (1) Champaign. Sept. 6. (OSM).

Other species of the Genus *Oedionychis* possible for Ohio: *Oe. vians* var. *scripticollis* (Say), *concinna* (Fab.).

Genus **Disonycha** Chev.

D. pennsylvanica (Ill.) (16) Ashtabula, Auglaize, Franklin, Hamilton, Jackson, Ottawa, Portage, Washington. April 23–Aug. 16. (CM, CSNH, JHH, OSM, OSU, OU).
D. procera Csy. (11) Ashtabula, Jackson, Lucas, Washington. June 3–July 14. (JHH, OSM, OSU).
D. uniguttata (Say) (42) Erie, Fairfield, Geauga, Jackson, Licking, Morgan, Perry. April 18–Aug. 7. (JHH, OSM, OSU).
D. alternata (Ill.) (188) Ashtabula, Erie, Franklin, Hocking, Licking, Lucas, Ottawa, Preble, Ross, Washington. May 5–Sept. 21. (JHH, OSM, OSU, OU).
D. caroliniana (Fab.) Hamilton. (CSNH).
D. fumata Lec. (1) Hamilton. (CSNH).
D. discoidea (Fab.) (8) Athens, Hamilton, Jackson, Lawrence, Meigs. May 9–Aug. 15. (CSNH, JHH, OSU, OU, RML).
D. discoidea var. **abbreviata** Melsh. (7) Athens, Hamilton. May 31–June 23. (CSNH, JHH).
D. admirabilis Blatch. (52) Adams, Gallia, Hocking, Jackson, Lawrence, Licking, Pike, Scioto, Vinton, Washington. May 18–Sept. 25. (JHH, OSM).
D. glabrata (Fab.) (510) Adams, Athens, Fairfield, Franklin, Gallia, Hamilton, Hocking, Jackson, Lawrence, Licking, Meigs, Pike, Ross, Scioto, Vinton, Washington. April 20–Oct. 23. (CSNH, JHH, OSM, OSU, OU, RML).
D. collata (Fab.) (1) Athens, Hamilton. June 26. (CSNH, JHH).
D. semicarbonata Lec. (1) Athens. (RML).
D. xanthomelas (Dalm.) (61) Ashtabula, Athens, Cuyahoga, Erie, Franklin, Hamilton, Hocking, Jackson, Licking, Meigs, Portage, Tuscarawas. April 23–Nov. 1. (CM, CSNH, JHH, OSM, OSU, OU, RML).
D. triangularis (Say) (18) Athens, Erie, Fairfield, Franklin, Hamilton, Lake, Lucas, Portage, Ross. April 1 to 9–Aug. 23. (CM, CSNH, JHH, OSM OSU).
D. mellicollis (Say) (9) Athens, Hamilton. May 15–Nov. 3. (CSNH, RML).
D. pallipes Cr. (4) Mercer, Portage, Summit. June 20–June 29. (CM, CSNH).

Genus **Sphaeroderma** Steph.

S. opima Lec. (11) Hamilton. May 19–July 18. (CSNH).

Genus **Altica** Geoffr.

A. bimarginata Say (30) Ashtabula, Erie, Hamilton, Hocking, Jackson, Lake, Licking, Lucas, Ottawa, Sandusky. May 8–Oct. 20. (CSNH, JHH, OSM, OSU, OU).
A. chalybea Ill. (34) Athens, Cuyahoga, Erie, Franklin, Hamilton, Hocking, Meigs, Richland, Ross. Mar. 29–Dec. 5. (CM, CSNH, JHH, OSM, OSU, OU, RML).
A. ignita Ill. (31) Athens, Fairfield, Franklin, Geauga, Hamilton, Hocking, Holmes, Jackson, Lawrence, Meigs, Vinton. April 23–Sept. 24. (CM, CSNH, JHH, OSM, OSU, OU).
A. ulmi Woods (141) Jackson. Nov. 11–Nov. 19. (JHH).
A. carinata Germ. (2) Hamilton, Scioto. Aug. 29. (CSNH, JHH).
A. fuscoaenea Melsh. (4) Hamilton. May 12. (CSNH).
A. burgessi Cr. Hamilton. (CSNH).
A. rufa Ill. (3) Franklin, Jackson. April 29–May 24. (JHH, OSU, OU).

Other species of the Genus *Altica* possible for Ohio: *A. rosae* Woods, *corni* Woods, *cuprascens* Blatch., *aenescens* Blatch., *vicaria* Horn, *torquata* Lec., *knabi* Blatch., *gloriosa* Blatch., *betulae* Schffr., *evicta* var. *shoemakeri* Schffr., *viatica* Blatch.

Genus **Lactica** Er.

L. iris (Oliv.) (2) Adams, Pike. Aug. 12–Aug. 24. (JHH).

Genus **Diphaulaca** Clark

D. bicolorata Horn (3) Hamilton. Mar. 24–Oct. 29. (CSNH).

Genus **Trichaltica** Har.

T. scabricula (Cr.) (7) Hamilton. May 14–June 4. (CSNH).

Genus **Chalcoides** Foudr.

C. helxines (L.) (1302) Adams, Ashtabula, Athens, Cuyahoga, Erie, Fairfield, Franklin, Gallia, Hamilton, Hocking, Jackson, Lake, Lawrence, Meigs, Perry, Pike, Ross, Scioto, Vinton, Washington. April 24–Oct. 22. (CM, CSNH, JHH, OSM, OSU, OU).
C. longula (Horn) (28) Athens, Franklin, Hamilton, Jackson, Logan, Pike, Vinton. May 3–Oct. 15. (CSNH, JHH, OSM, OU).

Other species of the Genus *Chalcoides* possible for Ohio: *C. helxines* var. *violacea* (Melsh.).

Genus **Derocrepis** Weise

D. erythropus (Melsh.) (57) Adams, Athens, Franklin, Gallia, Hamilton, Hocking, Jackson, Lawrence, Meigs, Ross. April 7–Oct. 7. (CSNH, JHH, OSM, OSU, OU, RML).
D. aesculi (Dury) (20) Franklin, Hamilton. April–May 24. (CSNH, OSU).

Genus **Crepidodera** Chev.

C. atriventris Melsh. (48) Athens, Cuyahoga, Franklin, Hamilton, Jackson, Lake, Pike, Scioto. Mar. 24–Oct. 21. (CM, CSNH, JHH, OSM, OU, RML).
C. nitens Horn (6) Athens, Hamilton. May 8–Aug. 1. (CSNH, JHH).

Genus **Hippuriphila** Foudr.

H. modeeri (L.) (8) Hamilton. May 20. (OSU).

Genus **Epitrix** Foudr.

E. fuscula Cr. (1503) Adams, Athens, Cuyahoga, Fairfield, Franklin, Gallia, Hamilton, Hocking, Jackson, Lawrence, Meigs, Pike, Ross, Scioto, Vinton. May 2–Oct. 21. (CSNH, JHH, OSU, OU, RML).
E. humeralis Dury (15) Athens, Hamilton, Jackson, Meigs, Ross. May 16–Aug. 23. (CSNH, JHH, OU).
E. lobata Cr. (3) Athens, Hamilton. May 13–May 22. (CSNH, OU).
E. cucumeris Har. (644) Adams, Ashtabula, Athens, Cuyahoga, Franklin, Gallia, Jackson, Licking, Meigs, Pike, Ross, Vinton, Washington. May 6–Oct. 18. (CSNH, JHH, OSM, OSU, OU).
E. brevis Sz. (31) Athens, Cuyahoga, Jackson, Meigs, Ross, Washington. May 21–Aug. 26. (JHH, OU).
E. parvula (Fab.) (1471) Adams, Athens, Hamilton, Jackson, Lawrence, Meigs, Pike, Ross, Vinton. July 5–Sept. 2. (CSNH, JHH, OU).

Genus **Orthaltica** Cr.

O. copalina (Fab.) (18) Athens, Cuyahoga, Hamilton, Hocking, Jackson, Lawrence, Summit. May 26–July 30. (CM, CSNH, JHH, OSM, OSU, OU, RML).

Other species of the Genus *Orthaltica* possible for Ohio: *O. melina* Horn.

Genus **Luperaltica** Cr.

L. fuscula (Lec.) (921) Adams, Athens, Gallia, Hocking, Jackson, Lawrence, Meigs, Pike, Ross, Scioto, Vinton. July 28–Sept. 26. (JHH, OU, RML).
L. senilis (Say) (2) Hamilton, Hocking, Scioto. July 20–Sept. 3. (CSNH, OSU, OU).

Genus **Mantura** Steph.

M. floridana Cr. (5) Cuyahoga, Franklin, Hamilton, Jackson. June 26–July 1. (CM, CSNH, JHH, OSM).

Genus **Chaetocnema** Steph.

C. protensa Lec. (4) Hamilton, Pike, Wayne. May 1–Aug. 18. (CSNH, JHH).
C. denticulata (Ill.) (9) Hamilton. May 14–Sept. 16. (CSNH).
C. cribrifrons Lec. (176) Adams, Athens, Jackson, Meigs, Scioto. July 4–Sept. 7. (JHH).
C. minuta Melsh. (132) Adams, Athens, Franklin, Gallia, Hamilton, Hardin, Hocking, Jackson, Lake, Meigs, Ross, Vinton. April 29–Sept. 27. (CSNH, JHH, OSU, OU, RML).
C. opulenta Horn (1) Hamilton. May 8. (CSNH).
C. parcepunctata Cr. Hamilton. (CSNH).
C. pulicaria Melsh. (40) Athens, Franklin, Hamilton. April 30–Oct. 19. (CSNH, OSU, OU).
C. confinis Cr. (73) Adams, Athens, Cuyahoga, Franklin, Gallia, Hamilton, Jackson, Meigs, Pike, Washington, Wayne. April 23–Oct. 28. (CSNH, JHH, OSM, OSU, OU, RML).
C. elongatula Cr. (3) Adams, Wayne. May 1–July 4. (CSNH).

Other species of the Genus *Chaetocnema* possible for Ohio: *C. irregularis* Lec., *subcylindrica* Lec., *pinguis* Lec., *protensa* var. *splendida* Gentn.

Genus **Systena** Clark

S. hudsonias (Forst.) (172) Ashtabula, Athens, Cuyahoga, Fairfield, Franklin, Gallia, Guernsey, Hamilton, Hocking, Jackson, Knox, Lucas, Meigs, Vinton, Wayne. May 22–Aug. 14. (CM, CSNH, JHH, OSM, OSU, OU, RML).
S. frontalis (Fab.) (33) Athens, Cuyahoga, Franklin, Jackson, Medina, Meigs, Portage, Washington. Jan. 16–Sept. 23. (CM, JHH, OSM, OU).
S. elongata (Fab.) (19) Athens, Cuyahoga, Gallia, Jackson, Medina, Meigs, Summit. July 27–Nov. 18. (CM, JHH, OSU).

S. taeniata (Say) (441) Adams, Ashtabula, Athens, Cuyahoga, Erie, Gallia, Hamilton, Jackson, Lake, Lawrence, Meigs, Pike, Ross, Scioto, Shelby, Vinton, Washington. May 30–Sept. 7. (CSNH, JHH, OSM, OSU, OU, RML).
S. blanda Melsh. Putnam, Wood. Blake (1935) examined this species from the Ohio counties given.
S. marginalis (Ill.) (49) Adams, Athens, Cuyahoga, Franklin, Gallia, Jackson, Lawrence, Meigs, Pike, Ross. Aug. 1–Sept. 17. (CSNH, JHH, OSM, OU).

Other species of the Genus *Systena* possible for Ohio: *S. plicata* Blatch.

Genus **Longitarsus** Latr.

L. turbatus Horn (15) Hamilton. April 1–Nov. 6. (CSNH).
L. alternatus (Zieg.) (19) Hamilton. May 12–June 21. (CSNH).
L. testaceus Melsh. (25) Athens, Cuyahoga, Hamilton, Jackson, Lake, Lucas, Meigs, Pike. Vinton. May 14–Oct. 15. (CSNH, JHH, OSU, OU).
L. melanurus Melsh. (16) Athens, Hamilton. April 23–Oct. 22. (CSNH, OU).
L. insolens Horn (1) Hamilton. June 12. (CSNH).
L. misellus Blatch. (24) Hamilton. April 5–Oct. 26. (CSNH).

Other species of the Genus *Longitarsus* possible for Ohio: *L. subrufus* Lec., *erro* Horn, *arenaceus* Blatch., *suspectus* Blatch., *saltatus* Blatch., *acutipennis* Blatch., *waterhousi* Kutschera.

Genus **Glyptina** Lec.

G. cyanipennis Cr. (2) Hamilton. July 8. (CSNH).
G. brunnea Horn (22) Athens, Franklin, Hamilton, Hocking, Ross. Jan. 9–April 19. (CSNH, JHH, OSM, OSU, OU).
G. spuria Lec. (16) Athens, Cuyahoga, Hamilton. Mar. 25–Nov. 6. (CM, CSNH, OU).

Other species of the Genus *Glyptina* possible for Ohio: *G. bicolor* Horn, *ferruginea* Blatch., *leptosoma* Blatch., *abbreviata* Gentn.

Genus **Phyllotreta** Foudr.

P. armoraciae (Koch) (114) Ashtabula, Athens, Cuyahoga, Franklin, Jackson. April 9–Oct. 25. (CM, JHH, OSM, OSU, OU).
P. robusta Lec. (1) Hamilton. June. (CSNH).
P. zimmermanni (Cr.) (61) Athens, Franklin, Hamilton, Jackson, Knox, Lawrence, Meigs, Ottawa, Vinton. April 5–Aug. 19. (CSNH, JHH, OSM, OSU, OU, RML).
P. vittata (Fab.) (318) Adams, Athens, Cuyahoga, Franklin, Gallia; Hamilton, Jackson, Lawrence, Meigs, Scioto. Jan. 27–Oct. 25. (CM, CSNH, JHH, OSU, OU).
P. bipustulata (Fab.) (60) Adams, Athens, Cuyahoga, Franklin, Gallia, Hamilton, Jackson, Meigs, Summit. Apr. 22–Dec. 25. (CM, CSNH, JHH, OSU, OU).
P. ulkei Horn (1) Franklin. April 5. (OSM).
P. lindahli Dury (5) Hamilton. May 20–May 30. (CSNH).
P. picta (Say) (45) Adams, Athens, Gallia, Hamilton, Jackson, Lawrence, Lucas, Ottawa, Vinton. May–Aug. 16. (CSNH, JHH, OSU, OU, RML).

Other species of the Genus *Phyllotreta* possible for Ohio: *P. liebecki* Schffr., *ramosa* (Cr.), *conjuncta* Gentn., *aeneicollis* (Cr.), *lewisii* (Cr.).

Genus **Tanygaster** Blatch.

Species of the Genus *Tanygaster* possible for Ohio: *T. ovalis* Blatch.

Genus **Aphthona** Chev.

A. insolita (Melsh.) (3) Athens, Hamilton. May 22–May 24. (CSNH, OU).

Genus **Dibolia** Latr.

D. borealis Chev. (382) Athens, Franklin, Hamilton, Jackson, Pike. Jan. 5–Dec. 25. (CSNH, JHH, OSU, OU, RML).

Other species of the Genus *Dibolia* possible for Ohio: *D. libonoti* Horn.

Genus **Psylliodes** Latr.

P. punctulata Melsh. (4) Athens, Franklin. June 24–June 26. (JHH, OSU).
P. convexior Lec. (17) Cuyahoga, Franklin, Hamilton, Jackson. April 24–Aug. 14. (CSNH, JHH, OSM, OSU).

Subfamily Hispinae

Genus **Stenispa** Baly

S. metallica (Fab.) (25) Fairfield, Franklin, Gallia, Hamilton, Jackson, Lawrence, Licking, Pickaway. April 29–Sept. 3. (CSNH, JHH, OSU).

Other species of the Genus *Stenispa* possible for Ohio: *S. collaris* Baly.

Genus **Anoplitis** Chap.

A. inaequalis (Web.) (228) Adams, Ashtabula, Athens, Carroll, Champaign, Cuyahoga, Fairfield, Gallia, Hamilton, Hocking, Jackson, Lawrence, Meigs, Ottawa, Pike, Ross, Vinton, Washington. May 5–Dec. 29. (CM, CSNH, JHH, OSM, OSU, OU, RML).

Genus **Chalepus** Thunb.

C. bicolor (Oliv.) (23) Athens, Clermont, Gallia, Hocking, Jackson, Lawrence, Meigs, Vinton. May 9–Sept. 3. (CSNH, JHH, OSM, OSU, OU).

C. scapularis (Oliv.) (6) Adams, Hocking, Jackson. July 2–Aug. 25. (CSNH, JHH, OSU).

C. dorsalis Thunb. (73) Adams, Ashtabula, Athens, Champaign, Cuyahoga, Gallia, Geauga, Hamilton, Jefferson, Lawrence. May 10–Oct. 20. (CM, CSNH, JHH, OSM, OSU, OU).

C. horni (Smith) (4) Adams, Athens, Lawrence. May 13–Sept. 1. (JHH, OSU, OU).

Genus **Baliosus** Weise

B. ruber (Web.) (45) Athens, Champaign, Cuyahoga, Fairfield, Franklin, Gallia, Hamilton, Hocking, Jackson, Ottawa, Ross. April 28–Oct. 8. (CM, CSNH, JHH, OSM, OSU, OU, RML).

Genus **Brachycoryna** Baly

Species of the Genus *Brachycoryna* possible for Ohio: *B. ?melsherimeri* (Cr.).

Genus **Octotoma** Suffr.

O. plicatula (Fab.) (21) Hamilton, Lawrence, Meigs. May 11–June 13. (CSNH, OSM, OSU).

Genus **Uroplata** Baly

U. porcata (Melsh.) (4) Athens, Hamilton. May 22–Aug. (CSNH, RML).

Genus **Microrhopala** Baly

M. vittata (Fab.) (48) Adams, Ashtabula, Champaign, Clermont, Cuyahoga, Erie, Fairfield, Hamilton, Jackson, Medina, Portage. May 15–Oct. 7. (CM, CSNH, JHH, OSU, OU).

Other species of the Genus *Microrhopala* possible for Ohio: *M. xerene* (Newn.), *excavata* (Oliv.), *cyanea* (Say).

Subfamily Cassidinae

Genus **Chelymorpha** Boh.

C. cassidea (Fab.) (88) Adams, Ashtabula, Athens, Clark, Clermont, Cuyahoga, Erie, Fairfield, Franklin, Fulton, Greene, Hamilton, Huron, Jackson, Lawrence, Licking, Meigs, Ottawa, Pike, Ross, Sandusky, Summit, Vinton, Washington, Wayne. Feb. 17–Sept. 12. (CM, CSNH, JHH, OSM, OSU, OU, RML).

Genus **Physonota** Boh.

Species of the Genus *Physonota* possible for Ohio: *P. unipunctata* (Say).

Genus **Cassida** L.

Species of the Genus *Cassida* possible for Ohio: *C. flaveola* Thunb.

Genus **Jonthonota** Spaeth

J. nigripes (Oliv.) (6) Clark, Cuyahoga, Greene, Hamilton, Jackson, Logan. June 8–Sept. 14. (CM, CSNH, JHH, OSU).

Genus **Gratiana** Spaeth

G. pallidula (Boh.) (127) Adams, Athens, Gallia, Hocking, Jackson, Lawrence, Meigs, Pike, Scioto, Washington. June 16–Aug. 29. (JHH, OSU, OU).

Genus **Chirida** Chap.

C. guttata (Oliv.) (175) Adams, Athens, Cuyahoga, Erie, Fairfield, Franklin, Gallia, Hamilton, Hocking, Jackson, Lake, Lawrence, Meigs, Ottawa, Pike, Ross, Scioto, Seneca, Summit, Vinton, Washington. April 28–Sept. 26. (CM, CSNH, JHH, OSU, OU, RML).

C. guttata var. **pennsylvanica** Sp. (46) Athens, Cuyahoga, Fairfield, Franklin, Hamilton, Highland, Jackson, Lawrence, Meigs, Mercer, Pike, Vinton. May 5–Oct. 11. (CM, CSNH, JHH, OSM, RML).

Genus **Deloyala** Chev.

D. clavata (Fab.) (24) Ashtabula, Athens, Cuyahoga, Erie, Hamilton, Hocking, Jackson, Meigs, Ottawa, Wood. May 24–Aug. 20. (CSNH, JHH, OSM, OSU, OU).

Genus **Metriona** Weise

M. bivittata (Say) (176) Adams, Athens, Clark, Fairfield, Greene, Hamilton, Highland, Hocking, Jackson, Lake, Lawrence, Meigs, Pike, Ross, Seneca, Vinton, Washington. April 15–Oct. 23. (CSNH, JHH, OSM, OSU, OU, RML).

M. bicolor (Fab.) (311) Adams, Ashtabula, Athens, Champaign, Clark, Cuyahoga, Erie, Fairfield, Franklin, Gallia, Greene, Hamilton, Highland, Hocking, Holmes, Jackson, Lake, Lawrence, Lucas, Meigs, Ottawa, Pike, Ross, Scioto, Seneca, Vinton, Washington. April 28–Oct. 13. (CM, CSNH, JHH, OSM, OSU, OU, RML).

M. purpurata (Boh.) (4) Athens, Hamilton, Vinton. May 17–Aug. 17. (CSNH, JHH).

LITERATURE CITED

Barber, H. S. *A Review of North American Tortoise Beetles (Chrysomelidae, Cassidinae).* Proc. Ent. Soc. Washington, Vol. XVIII, No. 2, 1916. pp. 113–127.

Blackwelder, Richard E. *Fourth Supplement* 1933 *to* 1938 *(inclusive) to (Leng) Catalogue of the Coleoptera of America North of Mexico.* Mount Vernon: John D. Sherman, Jr., 1939.

Blake, Doris Holmes. *A Revision of the Beetles of the Genus Oedionychis Occurring in America North of Mexico.* Washington: Government Printing Office, 1927. Proc. U. S. Nat. Mus., Vol. 70, Art. 23. pp. 1–44, pls. 1, 2.

Revision of the Species of Beetles of the Genus Trirhabda North of Mexico. Washington: Government Printing Office, 1931. Proc. U. S. Nat. Mus., Vol. 79, Art 2. pp. 1–36, pls. 1, 2.

Revision of the Beetles of the Genus Disonycha Occurring in America North of Mexico. Washington: Government Printing Office, 1933. Proc. U. S. Nat. Mus., Vol. 82, Art. 28. pp. 1–66, pls. 1–8.

Notes on Systena. Bulletin Brooklyn Ent. Society, Vol. XXX, No. 3, June, 1935. pp. 89–108, pl. 1.

Blatchley, W. S. *Coleoptera or Beetles Known to Occur in Indiana.* Indianapolis: Indiana Dept. of Geology and Nat. Resources, Bul. No. 1, 1910. 1385 pp.

Chittenden, F. H. *The Species of Phyllotreta North of Mexico.* Brooklyn Ent. Soc., VIII (New Series), No. 1, 1927. pp. 1–60, pls. 1, 2.

Dury, Charles. *A Revised List of the Coleoptera Observed Near Cincinnati, Ohio.* Jour. Cincinnati Soc. Nat. Hist., XX, 1902. pp. 107–196.

Additions to the List of Cincinnati Coleoptera. Jour. Cincinnati Soc. Nat. Hist., XX, No. 7, 1906. pp. 257–260.

Ecological Notes on Some Coleoptera of the Cincinnati Region, Including Seven New Species. Jour. Cincinnati Soc. Nat. Hist., XX, No. 7, 1906. pp. 251–256.

Fall, H. C. *A Revision of the North American Species of Pachybrachys.* Trans. Am. Ent. Soc., XLI (September, 1915). pp. 291–486.

Houser, J. S. *Destructive Insects Affecting Ohio Shade and Forest Trees.* Ohio Agr. Exp. Sta., Bul. 332, 1918. 487 pp.

Hughes, John H. *Chrysomelidae or Leaf Beetles of Southeastern Ohio.* Unpublished Master's Thesis, Ohio University, Athens, Ohio, 1939. 147 pp.

Krauss, N. L. H. *A Study of the Genus Glyptoscelis LeConte In America North of Mexico (Coleoptera, Chrysomelidae).* Berkeley, Calif.: Univ. of Calif. Press, 1937. Univ. of Calif. Publ. in Ent., Vol. 7, No. 2. pp. 21–32, 9 figs.

Leng, Charles W. *Catalogue of the Coleoptera of America North of Mexico.* Mount Vernon: John D. Sherman, Jr., 1920. 470 pp.

Leng, Charles W., and **Andrew J. Mutchler.** *Supplement* 1919 *to* 1924 *(inclusive) to Catalogue of the Coleoptera of America North of Mexico.* Mount Vernon: John D. Sherman, Jr., 1927.

Second and Third Supplements 1925 *to* 1932 *(inclusive) to Catalogue of the Coleoptera of America North of Mexico.* Mount Vernon: John D. Sherman, Jr., 1933.

Leonard, Mortimer D., et al. *A List of the Insects of New York.* Ithaca: Cornell Univ. Agr. Exp. Sta., Mem. 101, 1926. 1121 pp.

McCauley, R. H., Jr. *A Revision of the Genus Microrhopala in N. A., North of Mexico.* Bul. Brooklyn Ent. Soc., XXXIII, No. 4, 1938. pp. 145–169, pl. 1.

Mutchler, Andrew J., and **Harry B. Weiss.** *Leaf-Beetles of the Genus Galerucella Known to Inhabit New Jersey.* State of N. J. Dept. Agr., Cir. 98, 1926. 15 pp.

Schaeffer, Charles. *Revision of the New World Species of the Tribe Donaciini of the Coleopterous Family Chrysomelidae.* Brooklyn, N. Y.: Brooklyn Mus. Sci. Bul., Vol. 3, No. 3 (July, 1925). pp. 45–165, pl. 1.

Van Dyke, Edwin C. *A Review of the Genus Chrysolina Motschulsky in N. A. (Coleoptera, Chrysomelidae).* Bull. Brooklyn Ent. Soc., XXXIII, No. 2, 1938. pp. 45–58.

Woods, William Colcord. *The Biology of Maine Species of Altica.* Maine Agr. Exp. Sta., Bull. 273, 1918. pp. 149–204, pls.

A MUTATION IN CORN PERICARP

DAVID C. RIFE,[1]
The Ohio State University,
Columbus, Ohio

The ear of corn shown in Fig. 1 was observed in a farmer's corn field. The color variation is in the pericarp, the dark area being red, and the light portion yellow, the latter being due to yellow endosperm showing through colorless pericarp. The red pericarp was at first assumed to be the result of a mutation from colorless to dominant red pericarp. It was assumed that half of the red kernels should carry the gene for red pericarp in their embryos, if ovulary as well as pericarp tissue was descended from the mutant cell. In order to test this hypothesis, a few red and yellow kernals were planted separately.

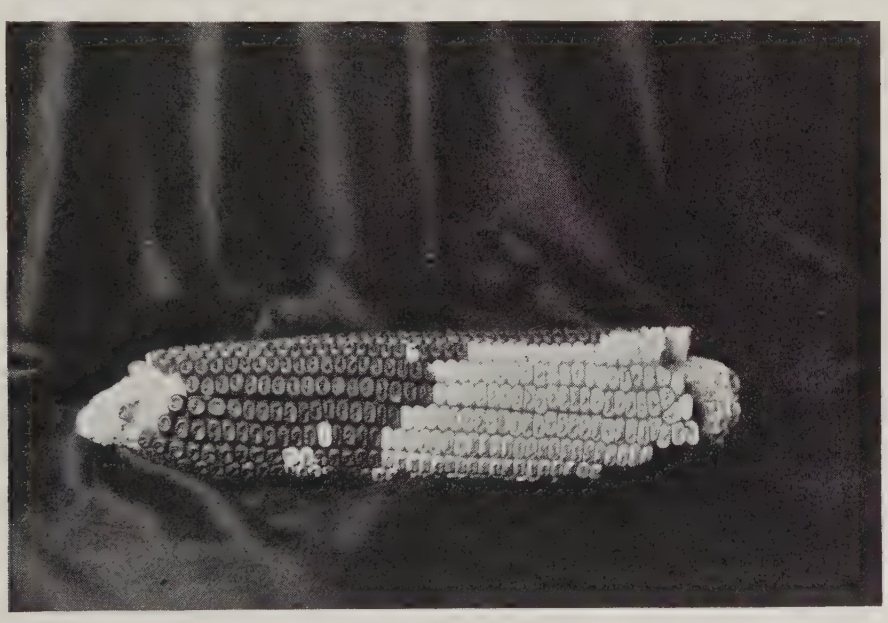


Fig. 1. Ear of corn in which a mutation occurred in the pericarp.

As predicted, half of the plants grown from red kernels produced solid red ears and the other half produced solid yellow ears (five plants of each). Surprising results were obtained from the yellow kernels. Instead of producing only plants with yellow ears, five produced plants with yellow ears and four produced plants with variegated ears. These variegated ears had red and colorless stripes in the pericarp of the individual kernels over the entire ears.

A series of multiple alleles determines pericarp color (Emerson, 1917; Hayes, 1917; Eyster, 1924). The gene P^{vv} results in variegated. Another gene, P^{wr} results in colorless, which is dominant to variegated. A third member of the series, P^{rr} results in solid red pericarp, which is dominant to both colorless and variegated.

[1]Genetics Laboratory, Department of Zoology and Entomology.

The plant which gave rise to the ear shown in Fig. 1 must have been heterozygous for colorless and variegated (P^{wr} P^{vv}). A mutation from variegated to red ($P^{vv} \rightarrow P^{rr}$) occurred in the developing ear. Female gametes within the red kernels were of two genotypes, half P^{rr} and half P^{wr}. They were fertilized by pollen from tissue of genotype P^{wr} P^{vv}. Half of the offspring of the red kernels should produce solid red ears and half should produce solid yellow ears. (P^{rr} P^{wr} x P^{wr} P^{vv}). The yellow kernels should produce offspring in the ratio of three with yellow ears to one with variegated ears (P^{wr} P^{vv} x P^{wr} P^{vv}). While the number of plants grown was too small to differentiate between 1 : 1 and 3 : 1 ratios, a mutation of the recessive gene for variegated to the dominant gene for solid red pericarp satisfactorily explains the peculiar breeding behavior.

LITERATURE CITED

Emerson, R. A. 1917. Genetical studies of variegated pericarp in maize. Genetics, 2: 1–35.
Hayes, H. K. 1917. Inheritance of a mosaic pericarp in maize. Genetics, 2: 260–284.
Eyster, W. H. 1924. A genetic analysis of variegation. Genetics, 9: 372–404.

Manual of Medical Parasitology

The contents of this book consist of the following parts: Preface, Table of Contents, Trematodes, Cestodes, Nematodes, Intestinal Protozoa, Hemoflagellates, Malarial Parasites of Man, Mosquitoes Which Transmit Disease, Flies which Transmit or Cause Disease, Other Bloodsucking Insects Which Transmit Disease, Ticks and Mites, Laboratory Diagnosis of Parasitic Infections, Reference Books, and Index. There are twelve pages of excellent figures and the one illustrating Plasmodium is in color.

This manual is designed to assist the medical student in identifying and studying in the laboratory those parasites which are often found in or on man. Numerous comments will assist the student in understanding the epidemiology and especially the diagnosis of parasitic infections. The manual is therefore valuable not only to students in college but to all wishing a rapid first survey or a thorough review of a subject which World War II has forced Americans to study.

—*C. E. Venard.*

A Manual of Medical Parasitology, by Clay G. Huff. x+88 pages. University of Chicago Press, 5750 Ellis Avenue, Chicago 37. 1943. Price, $1.50.

AN ANALYSIS OF FISHING EFFORT AT INDIAN LAKE

LOWELL E. BINKLEY,[1]
Section of Fish Management and Propagation,
Ohio Division of Conservation and Natural Resources,
Columbus, Ohio

Although the study of natural sciences dates back many centuries, the science of the management of fish populations is very young. Students of fish management have always been confronted with the major problem of estimating, within reasonable limits, the value of their efforts. Unlike the farmer, who may determine exactly the production of his lands, the biologist is still unable to determine the production of fish in any large body of water under natural conditions.

Numerous plans for the practical management of fish populations have been offered. As yet, no satisfactory method has been developed for testing the relative values of these plans. Thompson and Bennett (1938) in Illinois and Swingle and Smith (1942) in Alabama and others have supplied excellent data on the production of fish in ponds and lakes under more or less controlled conditions.

In newly constructed lakes it would be possible to keep a careful check on the number and weight of fish introduced. A check of all of the fish taken out of the lake over a period of years would produce some pertinent information. It is, however, impossible to contact all fishermen around most of our lakes.

The use of special chemicals, electrical devices and nets promises to supply valuable data when we arrive at the point where it is possible to standardize this information. For the present, we must rely upon random samples obtained by a creel census. This census may be conducted by the personal contact method or on a voluntary basis. The personal contact method has proven to be the more satisfactory of the two methods. At Indian Lake we combined the two methods by placing twenty creel census boxes at popular fishing landings. The individuals operating these landings assisted the fishermen in making out their reports of catch.

We should plan, however, to operate the creel census at Indian Lake over a period of years. Sufficient data may be acquired during this period to enable us to arrive at some definite conclusions as to the productive capacity of Indian Lake.

THE TOTAL CATCH

As previously suggested, the ideal method for the operation of a creel census is to check the creels of all fishermen as they leave the lake. With the means we had available, it was impossible to check the fifty miles of shore line and the approximately 7200 acres of water (Roach, 1935). The information obtained at this lake over a period of six months represents only a sample of the adult fish populations and provides no basis for computing the total production of fish. The total catch of 13,938 legal-sized fish by 1,104 fishermen results in an average daily catch of 12 legal-sized fish per fisherman. Only 611 undersized fish were reported as being caught and returned to the water. Approximately four fish in every hundred caught were undersized.

Throughout the period of the survey fifteen species of fish were caught. During April fourteen species of fish were caught and this number became less until, in August, only seven species were caught. Among the fifteen species of fish caught

[1]The writer is indebted to Dr. T. H. Langlois, Director of The Theodore Franz Stone Laboratory, and Dr. W. C. Beaver, Department of Biology, Wittenberg College, for their assistance and advice.

were six representatives of the sunfishes (*Centrarchidae*) and three of the catfishes (*Ameiuridae*). This report should probably show five species of catfish but, due to the inability of the layman to separate the bullheads, it was necessary to consider them as one species. Nearly eight sunfish were caught to two of all other species of fish. And of this two, approximately one and a half were catfish. Table I lists the number of each species taken each month as well as the total number taken throughout the period of the survey.

In considering only the sunfish and catfish it is interesting to observe that nine out of every ten of these two families of fishes caught in April were sunfish. This ratio became systematically reduced until, in August, the ratio of six sunfish to four catfish resulted. In other words, the spring season is the best period to fish

TABLE I

Total Catch of Fish

(Indian Lake Creel Census)

Species	April	May	June	July	Aug.	Sept.	Totals
Crappie	4,460	2,083	222	161	274	67	7,467
Bluegill	810	564	308	457	194	79	2,412
Channel Cat	529	423	190	360	265	100	1,867
L. M. Bass	606	17	65	56	55	0	799
Perch	63	58	50	302	130	102	705
Bullheads	231	25	34	44	86	10	403
Sunfish	29	26	16	36	10	23	140
Carp	7	3	10	9	5	0	34
Rock Bass	2	22	1	0	0	0	25
R. Trout	10	8	0	0	0	0	18
S. M. Bass	9	2	3	0	3	0	17
White Bass	9	3	0	0	0	0	12
Wall-eye Pike	4	0	0	2	0	0	6
Blue Cat	0	0	1	1	1	1	4
Goldfish	2	0	0	0	0	0	2
Totals	6,971	3,234	900	1,428	1,023	382	13,938

for sunfish and the late summer is the best period to obtain catfish. Table II indicates the percentage of the total catch per month for each species as well as the percentage of the total catch for each species.

Wickliff (1935) conducted a state-wide creel census from seven Ohio lakes. From the data supplied in this report an average daily catch of eleven legal-sized fish per fisherman was obtained. This survey, covering the same period of the year as the Indian Lake survey, further reveals that an average of 2.6 legal-sized fish were caught per hour. At Indian Lake an average of 12 legal-sized fish were caught at the rate of slightly more than two legal-sized fish per hour. This information is summarized for each month of the survey in Table III.

THE WEATHER

Weather conditions usually provide an excellent topic for discussion among fishermen. Some fish according to wind directions, others by periods of the moon, and, more recently, according to barometer readings. Daily observations are made at the conservation office at Russell's Point as to the air temperature, wind direction, relative strength of the wind, and precipitation. Daily water temperatures, although not available, would be highly desirable.

April and May, the two coldest months of the survey, provided the best crappie fishing. During the remaining four months of the survey the crappie catches were considerably reduced. In fact, April and May are the best months for most types of fishing. During the month of April and the early part of May the average daily catch of all species of fish follows, very closely, the daily air temperatures.

TABLE II

PERCENTAGE OF CATCH PER MONTH

(Indian Lake Creel Census)

Species	April	May	June	July	Aug.	Sept.
Crappie	66.84	64.40	24.66	11.27	26.78	17.03
Bluegill	11.76	14.34	34.22	32.00	18.86	20.86
Channel Cat	7.59	13.07	21.11	25.21	25.90	26.17
L. M. Bass	8.69	0.52	7.22	3.82	5.37	0.00
Perch	0.90	1.79	5.55	21.14	12.70	26.70
Bullheads	3.45	0.77	3.77	3.08	8.40	2.61
Sunfish	0.41	0.80	1.77	2.52	0.97	6.02
Carp	0.10	0.09	1.11	0.63	0.48	0.00
Rock Bass	0.02	0.68	0.11	0.00	0.00	0.00
R. Trout	0.14	0.24	0.00	0.00	0.00	0.00
S. M. Bass	0.12	0.06	0.33	0.00	0.29	0.00
White Bass	0.12	0.09	0.00	0.00	0.00	0.00
Wall-eye Pike	0.04	0.00	0.00	0.14	0.00	0.00
Blue Cat	0.00	0.00	0.11	0.07	0.09	0.26
Goldfish	0.02	0.00	0.00	0.00	0.00	0.00

TABLE III

CATCH PER HOUR FOR ALL SPECIES

(Indian Lake Creel Census)

Month	Number of Fishermen Reporting	Legal-sized Fish Taken	Average Number of Fish Per Fisherman	Average Number of Legal-sized Fish Per Hour
April	574	6,971	12.14	2.65
May	206	3,234	15.70	2.29
June	80	900	11.20	3.07
July	128	1,428	11.10	2.26
August	83	1,023	12.20	1.50
September	33	382	11.50	1.07
Totals	1,104	13,938	12.60	2.14

In other words, as the days become warmer the fishermen devote more and more time to fishing and, as a result, catch more fish. Once the waters of a lake reach their normal summer temperatures daily changes in air temperature have very little immediate influence upon the temperature of the water. During this period no correlation between daily catches of fish and daily air temperature is evident.

THE CRAPPIE FISHING

The best crappie fishing is provided during the months of April and May. From Table II it is quite evident that two out of every three legal-sized fish caught during April and May are crappies. The remaining four months of the survey show decided decline in crappie catches.

Although most of the crappie fishing is done from boats, there appears to be no great advantage over fishing from the shore. The average catch of legal-sized crappies among the boat fishermen was fourteen compared with twelve for the shore fishermen. Live minnows and artificial flies proved to be the most effective baits. All other types of baits used resulted in a fifty per cent reduction in catches.

THE BLUEGILL FISHING

Based on the information presented in Table II, June and July appear to be the best months for bluegill (*Lepomis macrochirus*) fishing. This is probably true for the majority of fishermen. From this table it would also appear that April and May provided the poorest bluegill fishing. This resulted, no doubt, from the fact that most of the people fishing the lake were using live minnows for bait and this type of bait was not very acceptable to the bluegills.

Those fishermen who specialized in bluegill fishing during April and May were very successful. Their average daily catch of bluegills was nearly seventy-five per cent of the daily bag limit of twenty bluegills. Using artificial flies, these fishermen consistently caught the most bluegills. Worms, although very popular as a bluegill bait, did not provide good catches except during the early part of the season. A boat is also essential to good bluegill fishing as is evidenced by the fact that the boat fishermen consistently caught twice as many bluegills as the shore fishermen.

CHANNEL CATFISHING

Table II reveals that July, August and September are the best months for the majority of the channel cat fishermen. This table would also seem to indicate that April and May are not good months to fish for channel catfish (*Ictalurus lacustris*). However, the same conditions which held down the bluegill catches during this period also appear to have reduced the catches of channel catfish. Very few channel catfish were caught with minnows.

More channel catfish were caught per day with worms during April than at any other time during the six-month survey. Soft "craws" and shrimp also proved to be very effective baits. A boat is essential for good catches of channel catfish as is evidenced by the fact that the average daily catch of the boat fishermen was three times that of the shore fishermen.

LARGEMOUTH BASS FISHING

For many years Indian Lake has been a favorite location for largemouth bass (*Huro salmoides*) fishing. The information supplied by these fishermen indicates that the month of April provides the best largemouth bass fishing. During this period the bass fishermen took home fifty per cent of the daily bag limit of six bass per trip. In fact, fifty per cent less time was required to catch a legal-sized bass in April than at any other time during the survey. The last two weeks of June also provided excellent bass fishing.

The boat fishermen consistently caught more bass than the shore fishermen and this indicates the importance of a boat for more successful bass fishing. During the early part of the season artificial baits were very effective. By the middle of July, soft "craws" appeared to be the best bait.

THE PERCH FISHING

Although the perch (*Perca flavescens*) ranked among the five most important game fishes during the period of the survey, this species appears to be finding it increasingly more difficult to maintain itself. September provided the best perch fishing. The perch caught during the summer months are small while the larger perch are caught during the winter months.

In view of the fact that the boat and shore fishermen caught, on the average, the same number of perch, there appears to be no advantage in fishing for perch from a boat. During April and May most of the perch were caught with live minnows while worms provided the best bait during the remainder of the season.

THE FISHING PRESSURE

During the early part of the season most of the fishermen come from communities near and around the lake. This is, no doubt, due to the fact that poor weather conditions discourage fishermen from driving long distances for a few hours of fishing. Lima supplies a higher percentage of the fishermen during this period than any other city. With the closing of the bass season throughout May and the first two weeks of June, most of the fishermen come from nearby communities.

It is interesting also to observe that by the first of July local interest in angling reaches a very low level. This condition continues throughout the remainder of the season. Among the cities supplying most of the fishermen during this period were Columbus, Dayton and Springfield. The Miami Valley supplies about one-half of the fishermen visiting the lake while the remainder come from all over Ohio as well as neighboring states.

THE CREEL CENSUS AND LAKE MANAGEMENT

The first step in planning an improvement project for a selected area is to complete an inventory. The creel census supplies information as to the size and relative abundance of the various species of fish inhabiting the lake. The program may then be directed toward improving habitat for the desired species of fish. Included in the inventory should be an evaluation of spawning facilities, cover and food supply.

From the study of lakes it becomes quite evident that each lake presents a new series of fish management problems. The size of the lake is also important due to the fact that the larger lakes are, as a general rule, more difficult to manage. Fortunately, however, the numerous islands of Indian Lake more or less divide the lake into a number of smaller lakes. Each of these smaller lakes may be treated as individual cases.

The major problem at Indian Lake is to reclaim the once productive bays of the east and west ends of the lake. Natural forces operating on a lake constantly move in the direction of destroying the lake. This movement can best be summarized as an ecological succession. As new soils are formed by the decomposition of aquatic vegetation some areas become isolated ponds. In time these ponds become swamps and, eventually, dry land.

Our first problem is to gain control of the aquatic vegetation dominating these bays. A certain amount of aquatic vegetation is required by fish but when these bays become "solid" with vegetation they no longer provide suitable habitat for the desirable species of fish. The submerged aquatic vegetation of Dunn's Pond, Cranberry, Long Island, Turkeyfoot and Sassafras areas require special attention. Waterweed (*Elodea*) and coontail (*Ceratophyllum*) constitute the vegetation problem

of the above mentioned areas. Both of these plants still dominate bays after several years of cutting with machines. Small pieces of the plants drift away during the cutting operation and supply many new areas with this type of vegetation.

The emergent aquatic vegetation of North Fork, Bear Wallow and Lucy's Pond present another type of vegetation problem. Cattails (*Typha*) constitute a major problem in these areas. This type of vegetation may be controlled by proper cutting. In Bear Wallow and Lucy's Pond channels and ponds should be cut out by dredge operation. This action will provide for the maximum circulation of water.

In areas where suitable gravel for spawning beds is not provided by dredging, additional gravel may be supplied. This can best be done by moving the gravel out on the ice. When the ice melts the gravel falls to the bottom to provide excellent spawning beds for game fish. Logs and stumps should be left in these areas to provide the necessary amount of cover. Some areas may require additional cover and logs and stumps may be supplied.

The improved areas should be set aside as sanctuaries throughout the spawning season. Such areas should be opened to fishing throughout the remainder of the year. The control of motor boats in fishing areas, proper bag limits, legal lengths and closed seasons complete the program.

CONCLUSIONS

1. The spring provides the best season for the greatest number and type of fishermen at Indian Lake.

2. The crappie is the dominant fish of Indian Lake and will continue as the dominant game fish as long as the conditions within the lake remain as they are at the present time.

3. The average daily catch of twelve legal-sized fish per fisherman compares favorably with other Ohio lakes.

4. Boat fishermen usually catch more fish than shore fishermen. Boat fishermen caught twice as many bluegills as the shore fishermen. Three times as many channel catfish were caught per unit of time from a boat as compared with the shore fishermen. Very few largemouth bass are caught from the shore.

5. Those fishermen who specialize in certain types of fishing consistently catch more fish than the "general" fishermen.

6. The fishing pressure is supplied locally during the early part of the season while the more distant communities supply most of the fishing pressure during the latter part of the season.

REFERENCES CITED

Roach, Lee S. Some physical, chemical and biological studies of impounded waters of Ohio. Transactions of the American Fishery Society, 63: 267–70. 1933.

Swingle, H. S. and **E. V. Smith.** Management of farm fish ponds. Agricultural Experiment Station, Alabama Polytechnic Institute, Auburn, Alabama. Bulletin 254, April, 1942.

Thompson, David H. and **G. W. Bennett.** The effect of crowding on the growth of game fishes; as shown by studies of Horseshoe Lake, 1931–38. Illinois Conservation Department, Urbana, Illinois. Summer 1939.

Wickliff, E. L. Summary of a preliminary creel census for seven Ohio lakes during the spring, summer and fall of 1935. Bulletin 95, Ohio Division of Conservation, Columbus, Ohio.